

**BID FOR  
FIRE STATION #6 CONSTRUCTION PROJECT**

**BID # 23/24-005**

**PWP # WA-2024-131**

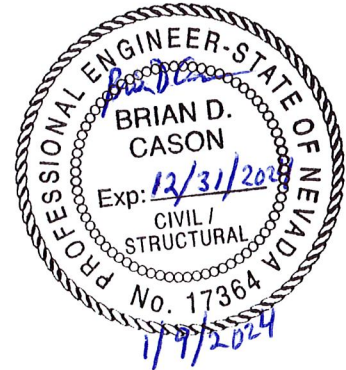
**BIDS DUE NOT LATER THAN: 1:45 PM ON FEBRUARY 14, 2024**

**PUBLIC BID OPENING: 2:00 PM ON FEBRUARY 14, 2024**

**[NOTE: TIME BIDS ARE DUE IS DIFFERENT FROM BID OPENING TIME]**



431 PRATER WAY  
P.O. BOX 857  
SPARKS, NV 89432-0857



Company Name: \_\_\_\_\_

**CITY OF SPARKS  
NOTICE TO BIDDERS  
FIRE STATION #6 CONSTRUCTION PROJECT  
BID # 23/24-005 / PWP # WA-2024-131**

NOTICE IS HEREBY GIVEN that the City of Sparks, Nevada, will receive written sealed bids only, for the project listed above. Said bids must be in the hands of the Capital Projects Manager at 431 Prater Way, Sparks, Nevada, NO LATER THAN **1:45 PM ON FEBRUARY 14, 2024**. Bids postmarked prior to, but not received until after this deadline will not be accepted. Vendor bid response submittals may not be sent to the City of Sparks via the Internet/e-mail and will not be entertained for award by the City of Sparks. The right is reserved to reject any Bid/Proposal or to accept the Bid/Proposal which is deemed by the City of Sparks to be in the best interest of the City of Sparks. The City of Sparks reserves the right to waive any irregularities and/or informalities in the bid process.

All Bids are to be marked clearly on the outside. Due to hybrid schedules and staff reductions, in-person staff availability is limited. Bidders wishing to physically deliver their bids on the bid due date shall note that the Engineering office will receive bids in the lobby of City Hall beginning at 1PM on FEBRUARY 14, 2024. Bids are due no later than 1:45PM. Bids may also be delivered to the Purchasing Department physical dropbox/mailbox, also located in the lobby of City Hall.

Bids will be opened and publicly read at **2:00 PM ON FEBRUARY 14, 2024** via Zoom video/audio conferencing. Meeting # 854 8452 5658. Meeting Passcode: 821573 with a direct link of: <https://cityofsparks-us.zoom.us/j/85484525658?pwd=1TYQLVoa3QXgzf2aMIKmVFAdhXDarF.1>

**PROJECT DESCRIPTION:**

This project is for the construction of a new fire station in north sparks, which includes the development of the parcel, grading, landscaping, sewer, storm drain, paving, concrete, masonry, framing, new generator, plumbing, mechanical, electrical, exhaust system, compressed air system, and final sprinkler design package, including all labor, equipment, materials and necessary incidentals.

**PRE-BID MEETING:** There will be a NON-MANDATORY pre-bid meeting held at 10AM on January 17, 2024 at the job site: 6963 Sheidbar Road, Sparks, NV 89434.

**BONDING/LICENSING:** A Bid Bond in the amount of 5% of bid amount is required. This bid bond will function as a penalty in the event the successful bidder fails to enter into a written contract with the City in accordance with the bid documents. Additionally, the City will be entitled to actual damages, if any. Prospective bidders will be required to have a current Contractor's License under the Nevada State Law for the type of work specified herein.

The work to be performed under this Contract shall be commenced by the successful Bidder after all executed Contract documents have been submitted, and after being notified to proceed by the City of Sparks.

Bid documents and specifications may be obtained from the City of Sparks website. Please visit <http://portal.cityofsparks.us/bids> to obtain complete bid documents. There is no cost to use the system or obtain plans, but registration at the site is required. It is the responsibility of all potential bidders/responders to monitor the Purchasing Division's website for any changing information prior to submitting their bid/proposal. The City of Sparks will not be responsible for the timeliness or completeness of information provided by any 3<sup>rd</sup> party bid listing or re-selling service. For further information, contact the Capital Projects Manager at [bcason@cityofsparks.us](mailto:bcason@cityofsparks.us) or at (775) 353-4083. The individual responsible for coordinating this bid is: Brian Cason, S.E., P.E. – Capital Projects Manager

Reno Gazette Journal Legal Notices Section  
Publish Date: January 10, 2024  
Proof of publication required

## **Bidder's Checklist**

Bidders are instructed to complete and return the following forms in order for their bids to be complete. Failure to return the following items may result in your bid being declared “non-responsive.”

1. \_\_\_\_\_ Bid Item Schedule
2. \_\_\_\_\_ Bidder Information Sheets
3. \_\_\_\_\_ Subcontractor Information Form (5% list due with bid submittal)
4. \_\_\_\_\_ Acknowledgement and Execution Form
5. \_\_\_\_\_ Certification Regarding Debarment
6. \_\_\_\_\_ “Certificate of Eligibility” (Local Preference) - If bid exceeds \$250,000 and Contractor wishes to potentially apply their preference.
7. \_\_\_\_\_ Bid Bond
8. \_\_\_\_\_ Signed Bid Addenda (if applicable)



**CITY OF SPARKS  
 FIRE STATION #6 CONSTRUCTION PROJECT  
 BID #23/24-005  
 PWP #WA-2024-131**

**PRICES** must be valid for 90 calendar days after the bid opening.

**COMPLETION** of this project is expected **PURSUANT TO CONTRACT DOCUMENTS.**

**BIDDER** acknowledges receipt of \_\_\_\_\_ Addenda.

\_\_\_\_\_  
 Bidder Name

\_\_\_\_\_  
 (signature)

**BID ITEM SCHEDULE:**

<b>BASE BID SCHEDULE</b>					
Item No.	Quantity	Unit	Description	Unit Price	Total Price
1	1	LS	This bid is for the construction of a new Fire Station in North Sparks and includes grading, paving, concrete, landscaping, masonry, new generator, electrical, mechanical, plumbing and all appurtenant work as stated in the plans and bid specifications, complete in place, per lump sum.	\$ _____ /LS	\$ _____
2	1	FA	Force Account	\$450,000.00	\$450,000.00
<b>TOTAL BASE BID</b>					\$ _____

**(Written amount TOTAL BASE BID):**

\$ \_\_\_\_\_

**Bid Schedule Notes:**

1. City of Sparks reserves the right and privilege to accept or reject any or all bids or parts thereof, based solely on the judgment of representatives of the City of Sparks.
2. **NV ENERGY, TMWA AND MASS GRADING PLANS ARE INCLUDED IN THE BID SET FOR REFERENCE ONLY AND WILL BE PART OF A SEPARATE CONTRACT, FURNISHED AND INSTALLED BY OTHERS.**
3. See Bid Item Clarifications.
4. Total base bid shall include Force Account Item #2 in the total base bid amount.

## Bidder Information

### COMPANY INFORMATION:

Company Name:
Contact Name:
Address:
City:
State / Zip Code:
Telephone Number including area code:
Fax Number including area code:
E-mail:

### COMPANY BACKGROUND

- 1) Has your company ever failed to complete any contracts awarded to it? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)
  
- 2) Has your company filed any arbitration request or law suits on contracts awarded within the last five years? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)
  
- 3) Does your company now have any legal suits or arbitration claims pending or outstanding against it or any officers relating to the performance of a public contract? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)
  
- 4) Does your company now employ any officers or principals who were with another firm when that company failed to complete a contract within the last five years? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)
  
- 5) Has your company had a contract partially or completely terminated for default (cause) within the past five years? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)
  
- 6) Has your company been found non-responsible on a government bid within the last five years? No \_\_\_ Yes \_\_\_ (If yes, please provide details.)

## Bidder Information

### CONTRACTOR LICENSE INFORMATION:

Nevada State Contractor's License Number (If Applicable):
License Classification(s):
Limitation(s) of License:
Date Issued:
Date of Expiration:
Name of Licensee:
City, State, Zip Code of Licensee:
Telephone Number of Licensee:

**BUSINESS LICENSING INFORMATION** All vendors doing business within the City of Sparks are required to obtain and maintain a current business license from the City of Sparks prior to commencement of work (Sparks Municipal Code Section 5.08.020A). Vendor(s) awarded a contract resulting from this bid shall be required to obtain a current business license if they do not already hold one.

City of Sparks Business License Number:
Date Issued:
Date of Expiration:
Name of Licensee:
City, State, Zip Code of Licensee:
Telephone Number of Licensee:
Taxpayer Identification Number:

## Bidder Information

### DISCLOSURE OF PRINCIPALS:

**a) Individual and/or Partnership:**

Owner 1) Name:
Address:
City, State, Zip Code:
Telephone Number:
Owner 2) Name:
Address:
City, State, Zip Code:
Telephone Number:
Other 1) Title:
Name
Other 2) Title:
Name:

**b) Corporation:**

State in which Company is Incorporated:
Date Incorporated:
Name of Corporation:
Address
City, State, Zip Code:
Telephone Number:
President's Name:
Vice-President's Name:
Other 1) Name:
Title:

## Awarded Contract Information

If your company is determined to be the awardee of the contract for this scope of work, the contract form for the work will be routed via electronic means. Therefore, please identify the authorized individual that will be signing the resulting contract. Presumably this will be the company owner or corporate officer authorized to bind the company for future work.

### COMPANY INFORMATION:

Company Name:
Authorized Name:
Title:
Individual E-Mail Address:
Telephone Number including area code:
Mailing Address:

**SUBCONTRACTOR DETAIL**  
**SUBCONTRACTORS EXCEEDING FIVE PERCENT OF BID AMOUNT**

**INSTRUCTIONS:** Per NRS 338.141, Bidder submits the following names of First-Tier Subcontractors who will provide to Bidder labor or a portion of the Work or improvements for which Subcontractor will be paid an amount exceeding five percent (5%) of the Bid Price. The Bidder shall list the name of a Subcontractor for each portion of the Work, the value of which exceeds five percent (5%) of the Bid Price. **If Bidder will perform more than 5% of the Work, BIDDER SHALL ALSO LIST HIS NAME and description of the work that the prime contractor will perform in the space provided below.**

Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		

**Bidder Name:** \_\_\_\_\_

**Authorized Signature:** \_\_\_\_\_

**SUBCONTRACTOR DETAIL**  
**SUBCONTRACTORS EXCEEDING ONE PERCENT OF BID AMOUNT OR \$50,000**

**INSTRUCTIONS:** In compliance with NRS 338.141, Bidder submits the following names of First-Tier Subcontractors who will provide to Bidder labor or a portion of the Work or improvements for which Subcontractor will be paid an amount exceeding one percent (1%) of the Bid or \$50,000, whichever is greater.

**Since all Subcontractors listed on the Bidder's 5% Subcontractor Information Form are over 1% of the Bid amount, those Subcontractors shall automatically be deemed incorporated into this 1% Subcontractor Information form and need not be re-listed below.**

Information provided must be submitted within two (2) hours after the completion of the opening of the bids (Per NRS 338.141). Bidder shall enter "NONE" under "Name of Subcontractor" if not utilizing subcontractors exceeding this amount. This form must be complete in all respects. If, additional space is needed, attach a separate page. The bidder may elect to submit this information with the bid proposal and, in that case, the bidder will be considered as having submitted this information within the above two hours.

Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		
Name of Subcontractor	Address	
Phone	Nevada Contractor License #	Limit of License
Description of Work:		

**Bidder Name:** \_\_\_\_\_ **Authorized Signature:** \_\_\_\_\_

**CITY OF SPARKS ACKNOWLEDGMENT AND EXECUTION:**

STATE OF \_\_\_\_\_ )  
 ) SS  
County of \_\_\_\_\_ )

\_\_\_\_\_(Name of Principal) being first duly sworn, deposes and says: That he/she is the Bidder, or authorized agent of the Bidder for whom the aforesaid described work is to be performed by; that he/she has read the Plans, Specifications, and related documents including but not limited to, any addenda issued and understands the terms, conditions, and requirements thereof; that if his/her bid is accepted that he/she agrees to furnish and deliver all materials except those specified to be furnished by the City of Sparks (Owner) and to do and perform all work for the **Fire Station #6 Construction Project, Bid # 23/24-005**, together with incidental items necessary to complete the work to be constructed and/or services to be provided in accordance with the Specifications, Plans, and Contract Documents annexed hereto.

**TO THE CONTRACTS AND RISK MANAGER OF THE CITY OF SPARKS:**

The undersigned, as Bidder, declares that the only persons or parties interested in this proposal, as principals, are those named herein, the Bidder is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid: that this proposal is made without collusion with any other person, firm or corporation; that he/she has carefully examined the location of the proposed work; the proposed form of Contract, the Contract Provisions, Plans, Specifications and Contract Documents incorporated therein referred to and made part thereof; that he/she proposes and agrees if this proposal is accepted, that he/she will contract with the City of Sparks in the form of the Contract prescribed, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the Contract and annexed Contract Provisions, Plans and Specifications, in the manner and time prescribed and according to the requirements of the Project Representative as therein set forth, it being understood and agreed that the quantities shown herein are approximate only and are subject to increase or decrease, and that he/she will accept, in full, payment therefore the indicated prices.

(Printed Name of Contractor/Bidder) Contractor/Bidder: \_\_\_\_\_  
BY: \_\_\_\_\_  
Firm: \_\_\_\_\_  
Address: \_\_\_\_\_  
City: \_\_\_\_\_  
State / Zip Code: \_\_\_\_\_  
Telephone Number: \_\_\_\_\_  
Fax Number: \_\_\_\_\_  
E-mail Address: \_\_\_\_\_  
(Signature of Principal) Signature: \_\_\_\_\_  
DATED this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

State of Nevada )  
 ) SS.  
County of \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, in the year 2023, before me,

\_\_\_\_\_/Notary Public, personally appeared \_\_\_\_\_ Personally known to me (or proved  
to me on the basis of satisfactory evidence) to be the person whose name is subscribed to this instrument, and acknowledged that he (she) executed it. WITNESS my hand and official seal.

Notary's Signature: \_\_\_\_\_ My commission Expires: \_\_\_\_\_



**CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER  
RESPONSIBILITY MATTERS**

**(This form to be signed and returned at the time of bid)**

This certification is required by the Federal Regulations Implementing Executive Order 12549, Debarment and Suspension, 45 CFR Part 93, Government-wide Debarment and Suspension, for the Department of Agriculture (7 CFR Part 3017), Department of Labor (29 CFR Part 98), Department of Education (34 CFR Parts 85, 668, 682), Department of Health and Human Services (45 CFR Part 76).

The prospective bidder, \_\_\_\_\_ certifies to the best of its knowledge and belief that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. Any exceptions provided will not necessarily result in denial of award, but will be considered in determining bidder responsibility and whether or not the City will enter into contract with the party. For any exception noted, indicate on an attached sheet to whom it applies, initiating agency, and dates of action. Providing false information may result in criminal prosecution or administrative sanctions.

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Typed Name & Title of Authorized Representative

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Signature of Authorized Representative

Date

I am unable to certify to the above statement. My explanation is attached.

Signature \_\_\_\_\_ Date \_\_\_\_\_

## Local Preference Affidavit

**NEW Instructions:** This form is required to receive a preference in bidding on projects exceeding \$250,000. This form must be submitted no later than two (2) hours following the opening of bids, only if the bidder wishes for their preferential status( established by their current Certificate of Eligibility) to be considered in the evaluation of bids. A copy of the bidder’s Certificate of Eligibility must be submitted at the time the contractor submits their bid.

I, \_\_\_\_\_, on behalf of the Contractor, \_\_\_\_\_, swear and affirm that in order to be in compliance with NRS 338.0117 and be eligible to receive a preference in bidding **Fire Station #6 Construction Project (Bid #23/24-005)** certify that the following requirement will be adhered to, documented and attained on completion of the contract. Upon submission of this affidavit on behalf of \_\_\_\_\_, I recognize and accept that failure to comply with any requirements is a material breach of the contract and entitles the City to damages. In addition, the Contractor may lose their preference designation and/or lose their ability to bid on public works for a period of time, pursuant to NRS 338:

1. The Contractor shall ensure at least 50 percent of workers employed on the public work possess a Nevada driver’s license or identification card;
2. The Contractor shall ensure all vehicles used primarily for the public work will be registered and (where applicable) partially apportioned to Nevada;
3. The Contractor shall ensure payroll records related to this project are maintained and available within the State of Nevada.

**These requirements are not applicable to Contractors who do not use the “Bidder’s Preference” eligibility certificate in their bid or do not receive an advantage in ranking of bids due to their preference status.**

By: \_\_\_\_\_ Title: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Signed and sworn to (or affirmed) before me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_ (name of person making statement).

State of \_\_\_\_\_ )  
  )ss.  
County of \_\_\_\_\_ )

\_\_\_\_\_ STAMP AND SEAL  
Notary Signature

**CITY OF SPARKS, NEVADA – 5% Bid Bond**

KNOW ALL MEN BY THESE PRESENTS: That we the undersigned \_\_\_\_\_, as “Principal,” and \_\_\_\_\_, as “Surety,” are hereby held and firmly bound unto the City of Sparks, Nevada, as “Obligee,” in the penal sum of \_\_\_\_\_ dollars (\$\_\_\_\_\_) for the payment of which, well and truly to be made, the Principal and Surety bind themselves, their heirs, executors, and administrators, successors and assigns, jointly and severally, by this instrument. The condition of the obligation of this bid bond is as follows:

WHEREAS, NRS 332.105 authorizes local governments to require bid bonds to insure execution and proper performance of the Contract and the Bonding Company has an “A” or better rating with Moody’s or A.M. Best and T-Listed with the U.S. Treasury Department;

AND, WHEREAS, the Principal has submitted a bid for Bid # **23/24-005**, PWP # **WA-2024-131**, for the **Fire Station #6 Construction Project**.

NOW, THEREFORE,

- (a) If said Bid shall be rejected; or
- (b) If said Bid shall be accepted and the Principal shall execute and deliver the contract in the bid documents (“Contract”) to Obligee in accordance with the terms of the bid documents, and give such bond or bonds as may be specified in the bid or contract documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or
- (c) If the Principal shall pay to the Obligee the full amount of the bid bond as a penalty irrespective of the Obligee’s actual damages in the event of the failure of the Principal to enter into such Contract and give such bond or bonds,

then, this obligation shall be null and void. Otherwise it shall remain in full force and effect, it being expressly understood and agreed that the liability of the Surety (but not of the Principal) for any and all claims hereunder shall, in no event, exceed the penal amount of the obligation as herein stated.

The Surety, for the consideration for which this bond was executed, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Obligee may accept such bid, and hereby waives notice of any such extension.

**IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and the Surety has caused their seal to be hereto affixed and these present to be signed by their proper officers.**

Signed, Sealed and dated: \_\_\_\_\_

\_\_\_\_\_  
Principal  
By: \_\_\_\_\_

\_\_\_\_\_  
Surety  
By: \_\_\_\_\_

# **GENERAL CONDITIONS**

## General Conditions



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### GENERAL CONDITIONS

*Please Read Carefully*

*These Provisions Are a Part of Your Bid and any Contract Awarded*

**Scope of Bid/Proposal:** Bids/Proposals are hereby requested for **FIRE STATION #6 CONSTRUCTION PROJECT**, as per specifications herein.

**The bidder agrees that:**

- A. Bidder has carefully examined the specifications, and all provisions relating to the item(s) to be furnished or the work to be done; understands the meaning, intent, and requirements; and
- B. Bidder will enter into a written contract and furnish the item(s) or complete the work in the time specified, and in strict conformity with the City of Sparks specifications for the prices quoted.

**Note:** Bidder is defined as any individual, partnership, or corporation submitting a bid, proposal, or quotation in response to a request for bid (RFB), request for proposal (RFP), request for information (RFI) or request for quotation (RFQ). A bidder may also be referred to as a bidder, contractor, supplier or vendor.

The use of the title "Bidder," "Vendor", "Contractor" or "Consultant" within this solicitation document and any resulting contract shall be deemed interchangeable and shall refer to the person or entity with whom the City of Sparks is soliciting and/or contracting for the service or product referenced within the bid document.

**1. Prices:**

All prices and notations must be in ink or typewritten. Mistakes may be crossed out and corrections typed or written with ink adjacent to the error. Bids shall indicate the unit price extended to indicate the total price for each item bid. Any difference between the unit price correctly extended and the total price shown for all items bid shall be resolved in favor of the unit prices. Bidders are encouraged to review all prices prior to bid submittal, as withdrawal or correction may not be permitted after the bid has been opened.

**2. Firm Prices:**

Prices on bid shall be firm prices not subject to escalation unless otherwise provided for in the specifications. In the event the specifications provide for escalation, the maximum limit shall be shown, or the bid shall not be considered. In the event of a decline in market price below a price bid, the City of Sparks shall receive the benefit of such decline.

**3. Items Offered:**

If the item offered by the bidder has a trade name, brand and/or catalog number, such shall be stated in the bid. If the bidder proposes to furnish an item of a manufacturer or vendor other than that mentioned on the face hereof, bidder must specify maker, brand, quality, catalog number, or other trade designation. Unless such is noted on the bid form, it will be deemed that the item offered is that designated even though the bid may state "or equal".

**4. Brand Names:**

Whenever reference to a specific brand name is made by the City, it is intended to describe a component that has been determined to best meet operational, performance, or reliability standards of the City, thereby incorporating these standards by reference within the specifications. These specifications are not meant to limit the vendor; they are guidelines to minimum qualifications. The bidder shall indicate their compliance or non-compliance for each line of the specification. Any deviations from the specifications or where submitted literature does not fully support the meaning of the specifications must be clearly cited in writing by the bidder.

## General Conditions



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An equivalent (“or equal”) may be offered by the bidder, subject to evaluation and acceptance by the City. It is the bidder’s responsibility to provide, at bidder’s expense, samples, test data, or other documentation the City may require to fully evaluate and determine acceptability of an offered substitute. The City reserves the sole right to reject a substituted component that will not meet or exceed City standards.

**5. Samples:**

Samples may be required for bid evaluation and testing purposes. Bidders shall agree to provide samples upon request and at no additional cost to the City.

**6. Withdrawal of Bids:**

Bids may be withdrawn by written or facsimile notice received prior to the exact hour and date specified for receipt of bid. A bid may also be withdrawn in person by a bidder, or bidder’s authorized representative, prior to the exact hour and date set for receipt of bids. Telephone withdrawals are not permitted.

**7. Late Bids, Modifications, or Withdrawals:**

Bids, modifications of bids, or bid withdrawals received after the exact time and date specified for receipt will not be considered.

**8. Mistake in Bid:**

- (a) If the bidder discovers a mistake in bid prior to the hour and date specified for receipt of bid, bidder may correct the mistake by withdrawing the bid in accordance with Item 7 above and resubmit prior to the stated bid deadline.
- (b) If within seventy-two hours of the bid closing and prior to the issuance of a purchase order or a contract, the apparent low bidder discovers a mistake in bid of a serious and significant nature, bidder may request consideration be given to withdrawing the bid. The mistake must be evident and provable. The right is reserved by the City to reject any and all requests for withdrawal of bids. The decision of the Purchasing Manager is final as regards acceptance or rejection of requests for withdrawal after closing of bids.
- (c) A mistake in bid cannot be considered once a purchase order or contract is issued.

**9. Signature:**

All bids shall be signed and the title and firm name indicated. A bid by a corporation shall be signed by an authorized officer, employee or agent with his or her title.

**10. Exceptions:**

A bidder deviating from specifications must specify any and all deviation(s). Failure to note said exceptions shall be interpreted to convey that the bidder shall propose to perform in the manner described and/or specified in this bid solicitation. If exception(s) are taken or alternatives offered, complete descriptions must be shown separately.

**11. Confidential Information:**

Any information deemed confidential or proprietary should be clearly identified by the bidder as such. It may then be protected and treated with confidentiality only to the extent permitted by state law. Otherwise the information shall be considered a public record. Information or data submitted with a bid will not be returned.

**12. Quality:**

Unless otherwise required in the specifications, all goods furnished shall be new and unused.



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**13. Litigation Warranty:**

The bidder, by bidding, warrants that bidder is not currently involved in litigation or arbitration concerning the materials or bidder's performance concerning the same or similar material or service to be supplied pursuant to this contract of specification, and that no judgments or awards have been made against bidder on the basis of bidder's performance in supplying or installing the same or similar material or service, unless such fact is disclosed to the City in the bid. Disclosure may not disqualify the bidder. The City reserves the right to evaluate bids on the basis of the facts surrounding such litigation or arbitration and to require bidder to furnish the City with a surety bond executed by a surety company authorized to do business in the State of Nevada and approved by The City of Sparks in a sum equal to one hundred percent (100%) of the contract price conditional on the faithful performance by bidder of the contract in the event the bid is awarded to bidder, notwithstanding the litigation or arbitration.

**14. Royalties, Licenses and Patents:**

Unless otherwise specified, the bidder shall pay all royalties, license and patent fees. The bidder warrants that the materials to be supplied do not infringe any patent, trademark or copyright and further agrees to defend any and all suits, actions and claims for infringement that are brought against the City, and to defend, indemnify and hold harmless the City from all loss or damages, whether general, exemplary or punitive, as a result of any actual or claimed infringement asserted against the City, the bidder or those furnishing material to bidder pursuant to this contract.

**15. Performance Standards:**

Performance of work and acceptability of equipment or materials supplied pursuant to any contract or award shall be to the satisfaction and full discretion of the City.

**16. Americans with Disabilities Act (ADA) Standards:**

Bidders shall be required to comply with current ADA Standards in preparing their bids and executing work required under any contract resulting from this bid. Completed work must comply with current ADA Standards.

**17. Warranties:**

(a) Unless otherwise specified, all workmanship, material, labor or equipment provided under the contract shall be warranted by bidder and/or manufacturer for a minimum of twelve (12) months after acceptance by City. Greater warranty protection will be accepted. Lesser warranty protection must be indicated by bidder on the bid proposal as an exception.

(b) Bidder shall be considered primarily responsible to the City for all warranty service, parts and labor applicable to the goods or equipment provided by bidder under this bid or award, irrespective of whether bidder is an agent, broker, fabricator or manufacturer's dealer. Bidder shall be responsible for ensuring that warranty work is performed at a local agency or facility convenient to City and that services, parts and labor are available and provided to meet City's schedules and deadlines. If required and defined within the Scope of Work, the Bidder will post a performance bond after contract award to guarantee performance of these obligations. Bidder may establish a service contract with a local agency satisfactory to City to meet this obligation if bidder does not ordinarily provide warranty service.

**18. Addenda:**

The effect of all addenda to the bid documents shall be considered in the bid, and said addenda shall be made part of the bid documents and shall be returned with them. Before submitting a bid, each bidder shall ascertain

## General Conditions



whether or not any addenda have been issued, and failure to acknowledge any such addenda may render the bid invalid and result in its rejection.

All potential bidders are responsible for monitoring the City website regarding the availability of new bid documents or addenda (where applicable). The City of Sparks will not be responsible for the results of any potential failures in automatic notification systems to potential bidders or plan holders with respect to these documents and will not adjust bid schedules or requirements due to any potential failures of those systems. It is the responsibility of all potential bidders/responders to monitor the Purchasing Division's website for any changing information prior to submitting their bid/proposal. The City of Sparks will not be responsible for the timeliness or completeness of information provided by any 3<sup>rd</sup> party bid listing or re-selling service.

### **19. Specifications to Prevail:**

The detailed requirements of the Specifications, Scope of Work or Special Conditions shall supersede any conflicting reference in these General Conditions or the stated language on the City of Sparks Standard Purchase Order that are in conflict therewith.

### **20. Taxes:**

The City is exempt from State, City and County Sales Taxes per NRS 372.325. The City will furnish Exemption Certificates for Federal Excise Tax when applicable. The successful bidder shall pay all taxes, levies, duties and assessments of every nature, which may be applicable to any work or materials under this Contract. The Contract Sum and any agreed variations thereof shall include all taxes imposed by law. The successful bidder shall make any and all payroll deductions required by law. The successful bidder herein indemnifies and holds the City harmless from any liability on account of any and all such taxes, levies, duties, assessments and deductions.

### **21. Prevailing Wages:**

Bidder is responsible for complying with all applicable local, State and Federal wage laws, whether or not specifically cited in this bid document.

Per NRS Sections 338.020 through 338.090, certain projects defined as "public works" require the payment of the prevailing wage as determined by the Labor Commissioner. Generally speaking, projects/contracts for construction of a public work valued at less than \$100,000 are exempt from the prevailing wage requirement (NRS 338.080). Bidder shall be fully aware of the prevailing wage requirements of the State of Nevada as detailed in NRS Chapter 338 and price their bid response accordingly. Further information concerning Prevailing Wage rates can be found at:

[https://labor.nv.gov/PrevailingWage/Public\\_Works\\_Prevailing\\_Wages/](https://labor.nv.gov/PrevailingWage/Public_Works_Prevailing_Wages/)

Federal "Davis Bacon" wages may be applicable if the funding for the project includes Federal funds. These requirements are detailed in the "Special Conditions – Federal Requirements" section that will be included in this bid document when such conditions apply. Contractor shall compare the applicable wage rate for each classification used on the project and pay the higher of the two rates (Nevada State Prevailing Wage or Davis Bacon Wage) in each case.





**22. Apprenticeship Utilization Act:**

Bidder acknowledges that the Nevada Legislature has enacted state laws requiring contractors engaged in vertical or horizontal construction who employ workers on one or more public works during a calendar year to use varying levels of apprentices on such public works. *See* NRS 338.01165; SB 82 (2023). Bidder acknowledges that Senate Bill 82 (2023) places compliance and reporting requirements on contractors and subcontractors engaged in public works project, and requires contractors and subcontractors engaged in public works projects to meet annual apprentice use thresholds set by state law, including obligations to provide the Nevada Labor Commissioner with supporting documentation when requested, and an obligation to provide an annual report to the Nevada Labor Commissioner documenting its compliance with Nevada apprenticeship requirements. Bidder acknowledges and certifies that it will comply with NRS 338.01165 and SB 82 (2023), as each may be amended in the future.

**23. Conflict of Interest:**

No City employee or elected or appointed member of City government, or member of the employee's immediate family, may participate directly or indirectly in the procurement process pertaining to this bid if they:

- (a) Have a financial interest or other personal interest that is incompatible with the proper discharge of their official duties in the public interest or would tend to impair their independence, judgment or action in the performance of their official duties.
- (b) Are negotiating for or have an arrangement concerning prospective employment with bidder. The bidder warrants to the best of his knowledge that the submission of the bid will not create such conflict of interest. In the event such a conflict occurs, the bidder is to report it immediately to the Purchasing Manager. For breach or violation of this warranty, the City shall have the right to annul this contract without liability at its discretion, and bidder may be subject to damages and/or debarment or suspension.

**24. Disqualification of Bidder:**

Any one or more of the following may be considered as sufficient for the disqualification of a prospective Bidder and the rejection of the Bid:

- (a) The Bidder is not responsive or responsible.
- (b) The quality of services, materials, equipment or labor offered does not conform to the approved plans and specifications.
- (c) There is evidence of collusion among prospective Bidders (Participants in such collusion will receive no recognition as Bidders).
- (d) The Bidder lacks the correct contractor's license classification required for the defined scope of work.
- (e) Lack of competency, understanding of the scope of work, adequate machinery, plant and/or equipment as revealed in routine due diligence associated with bid evaluation.
- (f) Unsatisfactory performance record as shown by past work for the City of Sparks, judged from the standpoint of workmanship, progress, and quality of services/goods provided.
- (g) Uncompleted work which, in the judgment of the City of Sparks, might hinder or prevent the prompt completion of additional work, if awarded.
- (h) Failure to pay or satisfactorily settle all bills due for labor and/or material on any contract(s).
- (i) Failure to comply with any requirements of the City of Sparks.
- (j) Failure to list, as required, all subcontractors who will be employed by the Bidder.
- (k) Any other reason determined, in good faith, to be in the best interest of the City of Sparks.

**25. Gratuities:**

The City may rescind the right of the bidder to proceed under this agreement if it is found that gratuities in the form of entertainment, gifts, cash or otherwise are offered or given by the bidder, or any agent or representative

## General Conditions



of the bidder, to any officer or employee of the City with the intent of influencing award of this agreement or securing favorable treatment with respect to performance of this agreement.

**26. Bidder's Security (This Section  IS  IS NOT Applicable to this bid):**

A bid deposit in an amount equal to at least 5% of the bid may be required as a bid security by the City. The bid security may only be in cash, a cashier's or certified check made payable to the City of Sparks, or a bid bond. If the bid security is a bond, it shall be executed by a surety insurer authorized to issue surety bonds in the State of Nevada. All Bonding Companies must have an "A" rating or better with Moody's or A.M. Best Company, and be included on the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bond and as Acceptable Reinsuring Companies" as published in circular 570 (as amended) by the audit staff, Bureau of Accounts, U.S. Treasury Department. (In other words, the company is T-listed.) The bid security must be executed by the bidder and enclosed with the bid proposal in the sealed bid envelope.

**27. Performance and Payment Bonds:**

Per NRS 339.025, before any contract, except one subject to the provisions of chapter 408 of NRS, exceeding \$100,000 for any project for the new construction, repair or reconstruction of any public building or other public work or public improvement of any contracting body is awarded to any contractor, he shall furnish to the contracting body the following bonds which become binding upon the award of the contract to the contractor (All Bonding Companies must have an "A" rating or better with Moody's or A.M. Best Company, and be included on the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bond and as Acceptable Reinsuring Companies" as published in circular 570 (as amended) by the audit staff, Bureau of Accounts, U.S. Treasury Department. (In other words, the company is T-listed.)):

**Performance Bond (This Section  IS  IS NOT Applicable to this bid):**

The Contractor awarded this bid will be required to furnish the City with a surety bond conditioned upon the faithful performance of the contract. This may take the form of a bond executed by a surety company authorized to do business in the State of Nevada and approved by the City of Sparks. The bond shall be in a sum equal to one hundred percent (100%) of the amount of the contract price. Such bond shall be forfeited to the City in the event that bidder receiving the contract shall fail or refuse to fulfill the requirements and all terms and conditions of the contract.

**Payment Bond (This Section  IS  IS NOT Applicable to this bid):**

The Contractor awarded this bid will be required to furnish the City with a payment bond. This may take the form of a bond executed by a surety company authorized to do business in the State of Nevada and approved by the City of Sparks. The bond shall be in a sum equal to one hundred percent (100%) of the amount of the contract price. The bond must be solely for the protection of claimants supplying labor or materials to the contractor to whom the contract was awarded, or to any of his subcontractors, in the prosecution of the work provided for in such contract.

**28. Indemnification:**

To the fullest extent permitted by law, upon award, Contractor shall hold harmless, indemnify, defend and protect City, its affiliates, officers, agents, employees, volunteers, successors and assigns ("Indemnified Parties"), and each of them from and against any and all claims, demands, causes of action, damages, costs, expenses, actual attorney's fees, losses or liabilities, in law or in equity, of every kind and nature whatsoever ("Claims") arising out of or related to any act or omission of Contractor, its employees, agents, representatives,

## General Conditions



or Subcontractors in any way related to the performance of work under this Agreement by Contractor, or to work performed by others under the direction or supervision of Contractor, including but not limited to:

1. Personal injury, including but not limited to bodily injury, emotional injury, sickness or disease, or death to persons;
2. Damage to property of anyone, including loss of use thereof;
3. Penalties from violation of any law or regulation caused by Contractor's action or inaction;
4. Failure of Contractor to comply with the Insurance requirements established under this Agreement;
5. Any violation by Contractor of any law or regulation in any way related to the occupational safety and health of employees.

In determining the nature of the claim against City, the incident underlying the claim shall determine the nature of the claim, notwithstanding the form of the allegations against City.

If City's personnel are involved in defending such actions, Contractor shall reimburse City for the time and costs spent by such personnel at the rate charged City for such services by private professionals.

### **In cases of professional service agreements, requiring professional liability coverage:**

If the insurer by which a Consultant is insured against professional liability does not so defend the City and applicable agents and/or staff, and the Consultant is adjudicated to be liable by a trier of fact, the City shall be entitled to reasonable attorney's fees and costs to be paid to the City by the Consultant in an amount which is proportionate to the liability of the of the Consultant.

Nothing in this contract shall be interpreted to waive nor does the City, by entering into this contract, waive any of the provisions found in Chapter 41 of the Nevada Revised Statutes.

### **29. Insurance:**

BIDDERS' ATTENTION IS DIRECTED TO THE INSURANCE REQUIREMENTS BELOW. IT IS HIGHLY RECOMMENDED THAT BIDDERS CONFER WITH THEIR RESPECTIVE INSURANCE CARRIERS OR BROKERS TO DETERMINE IN ADVANCE OF BID SUBMISSION THE AVAILABILITY OF INSURANCE CERTIFICATES AND ENDORSEMENTS AS PRESCRIBED AND PROVIDED HEREIN. IF THE APPARENT LOW BIDDER FAILS TO COMPLY STRICTLY WITH THE INSURANCE REQUIREMENTS, THAT BIDDER MAY BE DISQUALIFIED FROM AWARD OF THE CONTRACT.

**The City may, unless otherwise required by law, waive or reduce the insurance requirements itemized here, at the discretion of the city's Contracts and Risk Manager.**

Should work be required on City premises or within the public right-of-way, upon award of the contract, the bidder shall provide proof of insurance for the types of coverage, limits of insurance and other terms specified herein, prior to initiation of any services under City, Bid, Proposal or Contract. Coverage shall be from a company authorized to transact business in the State of Nevada and the City of Sparks and shall meet the following minimum specifications:

Contractor shall at its own expense carry and maintain at all times the following insurance coverage and limits of insurance no less than the following or the amount customarily carried by Contractor or any of its

**General Conditions**



subcontractors, whichever is greater. Contractor shall also cause each subcontractor employed by Contractor to purchase and maintain insurance of the type specified herein. All insurers must have AM Best rating not less than A-VII, and be acceptable to the City. Contractor shall furnish copies of certificates of insurance evidencing coverage for itself and for each subcontractor. Failure to maintain the required insurance may result in termination of this contract at City’s option. If Contractor fails to maintain the insurance as set forth herein, City shall have the right, but not the obligation, to purchase said insurance at Contractor’s expense.

Contractor shall provide proof of insurance for the lines of coverage, limits of insurance and other terms specified below prior to initiation of any services. Coverage shall be from a company authorized to transact business in the State of Nevada and the City of Sparks. Contractor and any of its subcontractors shall carry and maintain coverage and limits no less than the following or the amount customarily carried by Contractor or any of its subcontractors, whichever is greater.

<b>Applicable to this Contract</b>	<b>Insurance Type</b>	<b>Minimum Limit</b>	<b>Insurance Certificate</b>	<b>Additional Insured</b>	<b>Waiver of Subrogation</b>
<b>Yes</b>	General Liability/Umbrella (Excess) Liability	\$2,000,000	✓	✓	✓
<b>Yes</b>	Automobile Liability	\$1,000,000	✓	✓	
<b>Yes</b>	Workers’ Compensation	Statutory	✓	N/A	✓
<b>Yes</b>	Employer’s Liability	\$1,000,000	✓	N/A	
<b>No</b>	Professional Liability	\$1,000,000	✓	N/A	N/A
<b>No</b>	Pollution Legal Liability	\$1,000,000	✓	N/A	N/A

**Commercial General Liability**

Contractor shall carry and maintain Commercial General Liability (CGL) and, if necessary to meet required limits of insurance, commercial umbrella/excess liability insurance with a total limit of not less than the limits specified herein.

For contracts that are for the construction or improvement of public facilities, the Contractor shall obtain and maintain products and completed operations liability coverage through the statute of repose after completion of the project. Continuing commercial umbrella coverage, if any, shall include liability coverage for damage to the insured's completed work equivalent to that provided under ISO form CG 00 01.

There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse, underground property damage, or damage to the named insured’s work unless Subcontractor carries and maintains separate policies providing such coverage and provides Contractor evidence of insurance confirming the coverage.

***Minimum Limits of Insurance***

**\$2,000,000** Each Occurrence Limit for bodily injury and property damage

## General Conditions



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**\$2,000,000** General Aggregate Limit  
**\$2,000,000** Products and Completed Operations Aggregate Limit  
**\$10,000** Medical Expense Limit

If Commercial General Liability Insurance or other form with a general aggregate limit is used, it shall be revised to apply separately to this PROJECT or LOCATION.

### ***Coverage Form***

Coverage shall be at least as broad as the unmodified Insurance Services Office (ISO) Commercial General Liability (CGL) "Occurrence" form CG 00 01 04/13 or substitute form providing equivalent coverage and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).

### ***Additional Insured***

City, its officers, agents, employees, and volunteers are to be included as insureds using the applicable ISO additional insured endorsement(s) or substitute forms providing equivalent coverage, in respects to damages and defense arising from: activities performed by or on behalf of Contractor, including the insured's general supervision of Contractor; products and completed operations of Contractor; premises owned, occupied, or used by Contractor. The coverage shall contain no special limitations on the scope of protection afforded to City, its officers, employees, or volunteers. Additional insured status for City shall apply until the expiration of time within which a claimant can bring suit per applicable state law.

### ***Primary and Non-Contributory***

Contractor's insurance coverage shall apply as primary insurance with respect to any other insurance or self-insurance programs afforded to City, its officers, agents, employees, and volunteers. There shall be no endorsement or modification of the CGL to make it excess over other available insurance; alternatively, if the CGL states that it is excess or pro rata, the policy shall be endorsed to be primary with respect to the additional insured. Any insurance or self-insurance maintained by City, its officers, employees, or volunteers shall be excess of Contractor's insurance and shall not contribute with it in any way.

### ***Waiver of Subrogation***

Contractor waives all rights against City and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability or commercial umbrella liability insurance maintained pursuant to this agreement. Insurer shall endorse CGL policy as required to waive subrogation against the City with respect to any loss paid under the policy.

### ***Endorsements***

Policy forms or endorsements are required confirming coverage for all required additional insureds. The forms or endorsements for CGL shall be at least as broad as the unmodified ISO additional insured endorsement CGO 20 10 07/04 and CG 20 37 07/04 or substitute forms providing additional insured coverage for products and completed operations.

A waiver of subrogation in favor of City shall be endorsed to the policy using an unmodified Waiver of Transfer of Rights of Recovery of Others to Us ISO CG 24 04 05 09, or a substitute form providing equivalent coverage.

### ***Electronic Data Liability***

## General Conditions



If any underground work will be performed, Contractor shall maintain electronic data liability insurance applicable to the Project and insuring against liability arising out of the loss of, loss of use of, damage to, corruption of, inability to access, or inability to manipulate electronic data. This coverage shall be maintained with a limit of liability of not less than \$1,000,000 and provide coverage at least as broad as electronic data liability coverage form CG 04 37 (or substitute form providing equivalent coverage).

### ***Railroad Protective Liability***

For any construction or demolition work within fifty (50) feet of a railroad, Contractor shall maintain Railroad Protective Liability insurance on behalf of and in the name of the railroad, as named insured, with a limit of \$6,000,000 per occurrence or higher limit if required by the railroad. Contractor shall also ensure that any exclusions pertaining to the indemnification of a railroad are removed from its CGL policy or that ISO form CG 24 17 (Contractual Liability-Railroads Endorsements) is included in the coverage.

### **Business Automobile Liability**

#### ***Minimum Limits of Insurance***

**\$1,000,000** Combined Single Limit per accident for bodily injury and property damage or the limit customarily carried by Contractor, whichever is greater. No aggregate limit may apply. Coverage may be combined with Excess/Umbrella Liability coverage to meet the required limit.

#### ***Coverage Form***

Coverage shall be at least as broad as the unmodified Insurance Services Office (ISO) Business Automobile Coverage form CA 00 01 10/13, CA 00 25 10/13, CA 00 20 10/13 or substitute form providing equivalent coverage. Such insurance shall cover liability arising out of any auto (including owned, hired, and non-owned autos).

Pollution liability coverage at least as broad as that provided under the ISO pollution liability—broadened coverage for covered autos endorsement (CA 99 48) shall be provided, and the Motor Carrier Act endorsement (MCS 90) shall be attached for all contracts involving transportation of “hazardous material” as this term is defined by applicable law, including, but not limited to, waste, asbestos, fungi, bacteria and mold.

#### ***Additional Insured***

City, its officers, agents, employees, and volunteers are to be included as insureds with respect to damages and defense arising from the ownership, maintenance or use of automobiles owned, leased, hired, or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to City, its officers, employees, or volunteers. Additional insured status for City shall apply until the expiration of time within which a claimant can bring suit per applicable state law.

#### ***Endorsements***

A policy endorsement is required listing all required additional insureds. The endorsement for Business Automobile Liability shall be at least as broad as the unmodified ISO CA 20 48 10/13 or a substitute form confirming City’s insured status for Liability Coverage under the Who Is An Insured Provision contained in Section II of the coverage form ISO CA 00 01 10/13.

#### ***Waiver of Subrogation.***

Contractor waives all rights against City, its officers, agents, employees, and volunteers for recovery of damages to the extent these damages are covered by the commercial general liability or commercial umbrella

**General Conditions**



liability insurance maintained pursuant to this agreement. Contractor’s insurer shall endorse policy to waive subrogation against City with respect to any loss paid under the policy.

**Workers’ Compensation and Employer’s Liability**

Contractor shall carry and maintain workers’ compensation and employer’s liability insurance meeting the statutory requirements of the State of Nevada, including but not limited to NRS 616B.627 and NRS 617.210 or provide proof that compliance with the provisions of Nevada Revised Statutes Chapters 616A-D and all other related chapters is not required. It is understood and agreed that there shall be no coverage provided for Contractor or any Subcontractor of the Contractor by the City. Contractor agrees, as a precondition to the performance of any work under this Agreement and as a precondition to any obligation of the City to make any payment under this Agreement to provide City with a certificate issued by an insurer in accordance with NRS 616B.627 and with a certificate of an insurer showing coverage pursuant to NRS 617.210.

It is further understood and agreed by and between City and Contractor that Contractor shall procure, pay for and maintain the above-mentioned coverage at Contractor's sole cost and expense. Should Contractor be self-funded for workers’ compensation and employer’s liability insurance, Contractor shall so notify City in writing prior to the signing of this Contract. City reserves the right to approve said retentions, and may request additional documentation, financial or otherwise, for review prior to the signing of this Contract.

Upon completion of the project, Contractor shall, if requested by City, provide a Final Certificate for itself and each Subcontractor showing that Contractor and each Subcontractor had maintained the required Workers Compensation and Employer’s Liability by paying all premiums due throughout the entire course of the project.

Nevada law allows the following to reject workers’ compensation coverage if they do not use employees or subcontractors in the performance of work under the contract:

- Sole proprietors (NRS 616B.627 and NRS 617.210)
- Unpaid officers of quasi-public, private or nonprofit corporations (NRS 616B.624 and NRS 617.207)
- Unpaid managers of limited liability companies (NRS 616B.624 and NRS 617.207)
- An officer or manager of a corporation or limited liability company who owns the corporation or company (NRS 616B.624 and NRS617.207)

If a contractor has rejected workers’ compensation coverage under applicable Nevada law, the contractor must indicate the basis for the rejection of coverage and complete, sign and have notarized an Affidavit of Rejection of Coverage. The Affidavit must be completed, signed and notarized prior to performance of any work.

***Minimum Limits of Insurance***

Workers’ Compensation:	Statutory Limits
Employer’s Liability:	<b>\$1,000,000</b> Bodily Injury by Accident – Each Accident
	<b>\$1,000,000</b> Bodily Injury by Disease – Each Employee
	<b>\$1,000,000</b> Bodily Injury by Disease – Policy Limit

***Coverage Form***

## General Conditions



Coverage shall be at least as broad as the unmodified National Council on Compensation Insurance (NCCI) Workers Compensation and Employer's Liability coverage form WC 00 00 07/11 or substitute form providing equivalent coverage.

### **OTHER INSURANCE COVERAGES (IF APPLICABLE)**

**Professional Liability Insurance (if Applicable)**, \$1,000,000 each claim limits of liability or whatever limit is customarily carried by the Contractor, whichever is greater, for design, design-build or any type of professional services. If coverage is required on a claims-made or claims-made and reported basis, any applicable retroactive or pending & prior litigation dates must precede the effective date of this contract. Continuous coverage shall be maintained, or an extended reporting period shall be obtained for a period of at least three (3) years following completion of the project.

**Contractors Pollution Liability Insurance (If Applicable)**- \$1,000,000 per occurrence and \$2,000,000 aggregate or whatever amount is acceptable to the City for any exposure to "hazardous materials" as this term is defined in applicable law, including but not limited to waste, asbestos, fungi, bacterial or mold.

Coverage shall apply to bodily injury; property damage, including loss of use of damaged property or of property that has not been physically injured; cleanup costs; and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims.

City shall be included as an insured under Contractor's pollution liability insurance.

If coverage is required on a claims-made or claims-made and reported basis, any applicable retroactive or pending & prior litigation dates must precede the effective date of this contract. Continuous coverage shall be maintained, or an extended reporting period shall be obtained for a period of at least three (3) years following completion of the project.

If the scope of services as defined in this contract includes the disposal of any hazardous materials from the job site, Contractor must furnish to City evidence of pollution liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under this contract. Coverage certified to the City under this section must be maintained in minimum amounts of \$1,000,000 per loss, with an annual aggregate of at least \$2,000,000.

Lower tier sub-subcontractors, Truckers, Suppliers: Evidence confirming lower tier subcontractors, truckers and suppliers are maintaining valid insurance prior to beginning work on the project to meet the requirements set forth herein on Subcontractor, including but not limited to all additional insured requirements of Subcontractor.

### **ALL COVERAGES**

Coverage shall not be suspended, voided, canceled, or non-renewed by either CONTRACTOR or by the insurer, reduced in coverage or in limits except after thirty (30) days' prior written notice has been given to CITY except for ten (10) days' notice for nonpayment of premium.

### **DEDUCTIBLES AND RETENTIONS**

Any deductibles or self-insured retentions that exceed \$100,000.00 per occurrence or claim must be declared to and approved by the City's Contracts and Risk Manager and prior to signing this Contract. City is entitled to request and receive additional documentation, financial or otherwise, prior to giving its approval of the deductibles and self-insured retentions. Any changes to the deductibles or self-insured retentions made during



## General Conditions



the term of this Contract or during the term of any policy must be approved by City's Contracts and Purchasing Manager prior to the change taking effect. Contractor is responsible for any losses within deductibles or self-insured retentions.

### **OTHER INSURANCE PROVISIONS**

Should City and Contractor agree that higher coverage limits are needed warranting a project policy, project coverage shall be purchased and the premium for limits exceeding the above amount may be borne by City. City retains the option to purchase project insurance through Contractor's insurer or its own source.

Any failure to comply with reporting provisions of the policies shall not affect coverage provided to City, its officers, agents, employees, or volunteers.

### **ACCEPTABILITY OF INSURERS**

Insurance is to be placed with insurers with a Best's rating of no less than A-VII and acceptable to the City. City, with the approval of the Risk Manager, may accept coverage with carriers having lower Best's ratings upon review of financial information concerning Contractor and insurance carrier. City reserves the right to require that Contractor's insurer be a licensed and admitted insurer in the State of Nevada, or meet any applicable state and federal laws and regulations for non-admitted insurance placement.

### **VERIFICATION OF COVERAGE**

Contractor shall furnish City with certificates of insurance and with original endorsements affecting coverage required by this contract. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

Prior to the start of any Work, Contractor must provide the following documents to City of Sparks, Attention: Purchasing Division, P.O. Box 857, Sparks, NV 89432-0857:

- A. **Certificate of Insurance.** Contractor must provide a Certificate of Insurance form to the City of Sparks to evidence the insurance policies and coverage required of Contractor.
- B. **Additional Insured Endorsements.** An original Additional Insured Endorsement, signed by an authorized insurance company representative, must be submitted to the City of Sparks, by attachment to the Certificate of Insurance, to evidence the endorsement of the City of Sparks as additional insured.
- C. **Policy Cancellation Endorsement.** Except for ten (10) days' notice for non-payment of premium, each insurance policy shall be endorsed to specify that without thirty (30) days prior written notice to the City of Sparks, the policy shall not be suspended, voided, cancelled or non-renewed, and shall provide that notices required by this paragraph shall be sent by certified mailed to the address specified above. A copy of this signed endorsement must be attached to the Certificate of Insurance. If endorsements are not available, Contractor shall be responsible to provide prior written notice to City as soon as practicable upon receipt of any notice of cancellation, non-renewal, reduction in required limits or other material change in the insurance required under this Agreement.
- D. **Bonds (as Applicable).** Bonds as required and/or defined in the original bid documents.

## General Conditions



**All certificates and endorsements are to be addressed to the City of Sparks, Purchasing Division and be received and approved by City before work commences.** The City reserves the right to require complete certified copies of all required insurance policies at any time.

### **SUBCONTRACTORS**

Contractor shall include all Subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each Subcontractor. All coverages for Subcontractors shall be subject to all the requirements stated herein.

### **MISCELLANEOUS CONDITIONS**

1. Contractor shall be responsible for and remedy all damage or loss to any property, including property of City, caused in whole or in part by Contractor, any Subcontractor, or anyone employed, directed, or supervised by Contractor.
2. Nothing herein contained shall be construed as limiting in any way the extent to which Contractor may be held responsible for payment of damages to persons or property resulting from its operations or the operations of any Subcontractors under it, and such coverage and limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to City in this contract.
3. In addition to any other remedies City may have if Contractor fails to provide or maintain any insurance policies or policy endorsements to the extent and within the time herein required, City may, at its sole option:
  - a. Purchase such insurance to cover any risk for which City may be liable through the operations of Contractor under this Agreement and deduct or retain the amount of the premiums for such insurance from any sums due under the Agreement;
  - b. Order Contractor to stop work under this Agreement and/or withhold any payments which become due Contractor here under until Contractor demonstrates compliance with the requirements hereof; or,
  - c. Terminate the Agreement.
4. If Contractor's liability policies do not contain the standard ISO separation of insureds condition, or a substantially similar clause, they shall be endorsed to provide cross-liability coverage.

### **30. Safety Program:**

Upon award, the Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide all necessary protection to prevent damage, injury, or loss to:

1. All employees on the work site and all other persons who may be affected thereby.
2. All the work, materials, and equipment to be incorporated therein, whether in storage on or off the site.
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

Contractor shall comply with all applicable laws, ordinances, rules, regulations, and others of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. He shall erect and maintain, as required by existing conditions and progress on the work, all necessary safeguards for safety and protection, including posting danger signs, other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent utilities. Contractor shall comply with OSHA'S Hazard Communication Standards.

## General Conditions



Contractor shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to the Owner and the Engineer.

### 31. Award of Contract:

- (a) Bids/Proposals will be analyzed and award will be made to the lowest, responsive and responsible bidder whose bid conforms to the solicitation and whose bid is considered to be most advantageous to the City, price and other factors considered. Factors to be considered may include, but are not limited to: bidder's past performance, total unit cost, economic cost analysis, life cycle costs, warranty and quality, maintenance cost, durability, the operational requirements of the City and any other factors which will result in the optimum economic benefit to the City.
- (b) The City reserves the right to reject any item or items, to waive informalities, technical defects and minor irregularities in bids/proposals received; and to select the bid(s) or proposal(s) deemed most advantageous to the City. Should the City elect to waive a right it will not constitute an automatic waiver of that right in the future nor will it impact any other right or remedy. The City may consider bids/proposals submitted on an "all or nothing" basis if the bid/proposal is clearly designated as such.
- (c) The City reserves the right to award one or more contracts on the bids/proposals submitted, either by award of all items to one bidder or by award of separate items or groups of items to various bidders as the interests of the City may require, unless the bidder clearly specifies otherwise in his bid.
- (d) Upon acceptance by the City of Sparks, the solicitation, bid, proposal, or price quotation and issuance of a purchase order issued to the successful bidder shall be deemed to result in a binding contract incorporating those terms and these General Conditions without further action required by either party. Items are to be furnished as described in the bid and in strict conformity with all instructions, conditions, specifications, and provisions in the complete contract, as defined by this clause or any related integrated agreement.

### 32. Request for Proposal (RFP) Submittals:

In the case of Request for Proposals (RFP's), it should be noted that the documents submitted by prospective bidders are competitive sealed proposals and not competitive sealed bids. When proposals are opened, prices and other information will not be made public until the proposal is awarded. There shall be no disclosure of any bidder's information to competing bidders prior to the award of the proposal.

By their nature, proposals will include a number of variables that will vary based on the complexity of the product or service addressed within the proposal. Therefore, the evaluation of RFP's and the recommendation for award will not be based on price alone. Selection criteria will be better defined for each scope of work in the Special Conditions section of this bid.

Upon award of the contract, the executed contract and proposals will become public information. Accordingly, each proposal should be submitted on the vendor's most favorable terms from a price and technical standpoint.

### 33. Bidder Preference Law (This Section IS IS NOT Applicable to this bid):

This project will be bid and awarded under the Provisions(s) of NRS 338.147, which restricts preference given to certain contractors on Public Works Projects. The NRS cited in this section is meant to be a reference only. Each bidder shall acquaint himself with the latest provisions of NRS 338.147.

## General Conditions



If the Contract for any Public Works Construction Project is expected to cost \$250,000 or more, then all Contractors wishing to receive benefit of their preference status in the evaluation of bids must submit a copy of their Certificate of Bidder Preference issued by the State Contractor's Board. (Call 775-688-1141 or 775-486-1100 to obtain certification information from the State Contractors Board). Contractors who do not submit a preference certificate at the time of their bid are presumed to have wished not to exercise the benefit of their preference, or do not possess the certificate of eligibility.

To the extent Contractor has sought, qualified and receives a bidding preference on this project, pursuant to Nevada Revised Statutes Chapter 338, Contractor acknowledges and agrees that the following requirements will be adhered to, documented and attained for the duration of the Project:

1. At least 50 percent of the workers employed on the Project (including subcontractors) hold a valid driver's license or identification card issued by the Nevada Department of Motor Vehicles;
2. All vehicles used primarily for the public work will be (a) registered and (where applicable) partially apportioned to Nevada; or (b) registered in Nevada; and
3. The Contractor shall maintain and make available for inspection within Nevada all payroll records related to the Project.

Contractor recognizes and accepts that failure to comply with any requirements herein shall be a material breach of the contract and entitle the City of Sparks to liquidated damages in the amount set by statute. In addition, the Contractor recognizes and accepts that failure to comply with any requirements herein may lose its certification for a preference in bidding and/or its ability to bid on any contracts for public works pursuant to NRS Chapter 338.

To the extent Contractor has sought, qualified and receives a bidding preference, and this project has a value of over \$250,000 pursuant to Nevada Revised Statutes Chapter 338, each contract between the contractor, applicant or design-build team and a subcontractor must provide for the apportionment of liquidated damages assessed pursuant to this section if a person other than the Contractor was responsible for the breach of a contract for a public work caused by a failure to comply with a requirement of Items 1-3 within this section. The apportionment of liquidated damages must be in proportion to the responsibility of each party for the breach.

This section shall not be applicable for projects in which some or all of the funding comes from Federal sources.

### **34. Tie Bids:**

Should identical low, responsive and responsible bids be received from two bidders, the City of Sparks Purchasing Manager shall notify all parties involved in the tie and may at his option utilize a coin-flip to determine the low bidder who shall be recommended for award. Or;

Should there be three or more low, responsive and responsible tie bids the Purchasing Manager shall exercise the following tie breaking method, unless another alternative is apparent and prudent: The City of Sparks Purchasing Manager shall set a mutually agreed upon time where, in his office, he shall shuffle a new deck of playing cards and have each bidder's representative cut the cards. The tie bidder who cuts the highest card (with Ace high) shall be recommended for bid award.



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**35. Appeals/Protests – Bids Only (Not Applicable to Request for Proposals):**

A person who submits a bid on a contract may, after the bids are opened and within 5 business days after the date the “Recommendation to Award” is issued by the City, unless otherwise stated in the Special Conditions, file a notice of protest regarding the awarding of the contract. The City’s “Recommendation to Award” will be dated and posted on the City’s public website within the area where bid notices and bid re-caps are posted (Currently: <http://www.cityofsparks.us/bids>).

- (a) A notice of protest must include a written statement setting forth with specificity the reasons the person filing the notice believes the applicable provisions of law were violated.
- (b) A person filing a notice of protest may be required by the governing body or its authorized representative, at the time the notice of protest is filed, to post a bond with a good and solvent surety authorized to do business in this State or submit other security, in a form approved by the governing body or its authorized representative, to the governing body or its authorized representative who shall hold the bond or other security until a determination is made on the protest. A bond posted or other security submitted with a notice of protest must be in an amount equal to the lesser of:
  - (1) Twenty-five percent of the total value of the bid submitted by the person filing the notice of protest; or
  - (2) Two hundred fifty thousand dollars (\$250,000).
- (c) A notice of protest filed in accordance with the provisions of this section operates as a stay of action in relation to the awarding of any contract until a determination is made by the governing body or its authorized representative on the protest.
- (d) A person who submits an unsuccessful bid may not seek any type of judicial intervention until the governing body or its authorized representative has made a determination on the protest and awarded the contract.
- (e) A governing body or its authorized representative is not liable for any costs, expenses, attorney’s fees, loss of income or other damages sustained by a person who submits a bid, whether or not the person files a notice of protest pursuant to this section.
- (f) If the protest is upheld, the bond posted or other security submitted with the notice of protest must be returned to the person who posted the bond or submitted the security. If the protest is rejected, a claim may be made against the bond or other security by the governing body or its authorized representative in an amount equal to the expenses incurred by the governing body or its authorized representative because of the unsuccessful protest. Any money remaining after the claim has been satisfied must be returned to the person who posted the bond or submitted the security.

**36. Documentation:**

Due to the time constraints that affect contract performance, all required documents, certificates of insurance and bonds shall be provided to the City within ten (10) calendar days following award or date of request by City, whichever is later. Any failure to comply may result in bid being declared non-responsive and rejected, and at City’s option, the bid bond may be attached for damages suffered.

**37. Discounts:**

- (a) Prompt payment discounts will not be considered in evaluating bids for award. However, offered discounts will be taken if payment is made within the discount period, even though not considered in the evaluation of bids.
- (b) In connection with any discount offered, time will be computed from date of delivery and acceptance, or invoice receipt, whichever is later. Payment is deemed to be made for the purpose of earning the discount on the date of mailing of the City check.

## General Conditions



(c) Any discount offered other than for prompt payment should be included in the net price quoted and not included in separate terms. In the event this is not done, the City reserves the right to accept the discount offered and adjust prices accordingly on the Purchase Order.

### **38. Seller's Invoice:**

Invoices shall be prepared and submitted in duplicate to the address shown on the Purchase Order. Separate invoices are required for each Purchase Order. Invoices shall contain the following information: Purchase Order number, item number, description of supplies or services, sizes, unit of measure, quantity, unit price and extended totals.

### **39. Inspection and Acceptance:**

Inspection and acceptance will be at destination unless specified otherwise, and will be made by the City department shown in the shipping address or other duly authorized representative of the City. Until delivery and acceptance, and after any rejection, risk of loss will be on the bidder unless loss results from negligence of the City.

### **40. Lost and Damaged Shipments:**

Risk of loss or damage to items prior to the time of their receipt and acceptance by the City is upon the bidder. The City has no obligation to accept damaged shipments and reserves the right to return at the bidder's expense damaged merchandise even though the damage was not apparent or discovered until after receipt of the items.

### **41. Late Shipments:**

Bidder is responsible to notify the City department receiving the items and the Purchasing Manager of any late or delayed shipments. The City reserves the right to cancel all or any part of an order if the shipment is not made as promised.

### **42. Document Ownership:**

All technical documents and records originated or prepared pursuant to this contract, including papers, reports, charts, and computer programs, shall be delivered to and become the exclusive property of the City and may be copyrighted by the City. Bidder assigns all copyrights to City by undertaking this agreement.

### **43. Advertisements, Product Endorsements:**

City employees and agencies or organizations funded by the City of Sparks are prohibited from making endorsements, either implied or direct, of commercial products or services without written approval of the City Manager. No bidder may represent that the City of Sparks has endorsed their product or service without prior written approval.

### **44. Vendor Workplace Policies**

No Vendor providing a service, program or activity to the public on behalf of the City shall discriminate against any person because of sex, race, color, creed, national origin or disability. Vendor, if providing a service, program or activity to the public on behalf of the City, shall comply with the Americans with Disability Act and City's policies pursuant thereto when providing said service, program or activity.

The City of Sparks is an Affirmative Action/Equal Opportunity Employer. Bidders shall be cognizant of the requirements for compliance with Executive Order 11246, entitled "Equal Employment Opportunity" as

## General Conditions



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amended by Executive Order 11375 and as supplemented in regulations of the U.S. Department of Labor (41 CFR part 60).

### **45. Business License Requirement:**

All companies doing business with, or within, the City of Sparks are required to obtain and maintain a current business license from the City of Sparks prior to the commencement of work per Sparks Municipal Code Section 5.08.020A. Bidder(s) awarded a contract resulting from this bid shall be required to obtain a current business license if they do not already possess one.

### **46. City Provisions to Prevail:**

Except as indicated in the specifications, the City's standard General Conditions shall govern any contract award. Any standard terms and conditions of bidder submitted by bidder shall not be acceptable to City unless expressly agreed to by the City. The City reserves the right to reject bidder's bid as non-responsive, to consider the bid without bidder's standard terms and conditions, or to require bidder to delete reference to such, as a condition of evaluation or award of the bid. If, after award of contract, bidder (contract vendor) provides materials or services accompanied by new or additional standard terms or conditions, they too shall be considered void and City may require deletion as a further condition of performance by vendor.

### **47. Invalid Provisions:**

In the event that any one or more of the provisions of this agreement shall be found to be invalid, illegal or unenforceable, the remaining provisions shall remain in effect and be enforceable.

### **48. Amendments and Modifications:**

The Purchasing Manager may at any time, by written order, and without notice to the sureties, make a modification to the contract or an amendment to the Purchase Order, within the general scope of this contract, in (1) quantity of materials or service, whether more or less; (2) drawings, designs, or specifications, where the supplies to be furnished are to be specially manufactured for the City; (3) method of shipment or packing; and (4) place of delivery. If any such change causes an increase or decrease in the cost or the time required for the performance of this contract, an equitable adjustment shall be made by written modification of the contract or amendment to the Purchase Order. Any claim by the bidder for adjustment under this clause must be asserted within 30 calendar days from the notification date.

### **49. Assignment:**

Vendor shall not assign or delegate duties or responsibilities under this agreement, in whole or in part, without prior written approval of the City.

### **50. Disputes After Award:**

Except as otherwise provided in these provisions, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Purchasing Manager, who shall reduce this decision to writing and mail a copy to the bidder. The decision of the Purchasing Manager shall be final and conclusive, unless bidder requests arbitration within ten (10) calendar days. Pending final decision of a dispute, the bidder shall proceed diligently with the performance of the contract and in accordance with the Purchasing Manager's decision.

### **51. Arbitration after Award:**

Any and all disputes, controversies or claims arising under or in connection with the contract resulting from this bid, including without limitation, fraud in the inducement of this Contract, or the general validity or

## General Conditions



enforceability of this Contract, shall be governed by the laws of the State of Nevada without giving effect to conflicts of law principles, may be submitted to binding arbitration before one arbitrator, and shall be conducted in accordance with the Commercial Arbitration Rules of the American Arbitration Association in a private manner in Washoe County, Nevada. This award shall be final and judgment may be entered upon it in any court having jurisdiction thereof. In reaching this final award, the arbitrator shall have no authority to change or modify any provision of this Contract. All other expenses of arbitration shall be borne equally by the parties. All fees, including legal fees, shall be borne by the party who incurred them. All costs of enforcement shall be borne by the losing party. Each party shall have the right to discovery in accordance with the Nevada Rules of Civil Procedure.

### **52. Lawful Performance:**

Vendor shall abide by all Federal, State and Local Laws, Ordinances, Regulations, and Statutes as may be related to the performance of duties under this agreement. In addition, all applicable permits and licenses required shall be obtained by the vendor, at vendor's sole expense.

### **53. Annual Appropriation of Funds:**

Multi-year term supply and service contracts and leases are subject to annual appropriation of funds by the City Council. The City plans and makes appropriations to the City Budget with respect to a fiscal year that starts July 1<sup>st</sup> and ends June 30<sup>th</sup> of each year. Payments made under term contracts and leases are considered items of current expense. Purchase Orders are funded when issued; therefore, they are current expense items and are not subject to any subsequent appropriation of funds.

Continuance of a multi-year contract beyond the limits of funds available shall be contingent upon appropriation of the requisite funds in the ensuing fiscal year and the termination of this contract due to lack of appropriation shall be without penalty.

### **54. Extension:**

When in the City's best interest, this agreement may be extended on a daily, month-to-month, or annual basis by mutual agreement of both parties. Services and/or materials received under an extension shall be in accordance with pricing, terms, and conditions, as described herein.

### **55. Termination:**

The City may terminate this agreement and be relieved of any consideration to the vendor should vendor fail to perform in the manner required. Furthermore, the City may terminate this agreement for any reason without penalty upon giving thirty (30) days written notice to the vendor. In the event of termination, the full extent of City liability shall be limited to an equitable adjustment and payment for materials and/or services authorized by and received to the satisfaction of the City prior to termination.

### **56. Venue:**

This agreement shall be governed by and interpreted according to the laws of the State of Nevada, and venue for any proceeding shall be in Washoe County.



# **Special Conditions and Specifications (Specific to Project)**

**In instances where the Special Conditions conflict with the General Conditions, the Special Conditions will prevail with respect to that instance or item(s).**

**SPECIAL PROVISIONS  
FIRE STATION #6 CONSTRUCTION PROJECT  
BID #23/24-005  
PWP #WA-2024-131**

These Special Provisions supplement and modify the "Standard Specifications for Public Works Construction" (Orange Book), 2012 Edition, and building codes currently adopted by the City of Sparks, Nevada. All of the requirements and provisions of said codes and specifications shall apply except where modified by the City General Conditions, contract forms, plans, plan specifications, and these Special Provisions (all contained within this bid document). **Orange Book Section 100.12 Contract – the last paragraph “The Bidder to whom award is made, shall not subcontract more than 50 percent of the total cost of the project”, does not apply to this project.**

**SECTION 1: SCOPE OF WORK**

Work Scope: The base bid work includes, but is not limited to, construction of a new Fire Station in North Sparks and includes grading, paving, concrete, landscaping, masonry, new generator, electrical, mechanical, plumbing, and all other miscellaneous associated work activities necessary to complete the project as stated in the plans and bid documents. The location of the work is at 6963 Sheidbar Road, within the City limits of the City of Sparks, Washoe County, Nevada, and is more specifically designated in the plans for this project. Prevailing wage miles shall be calculated from Reno City Hall to the project location (11.3 miles for this project).

**The NV Energy, TMWA and mass grading plans have been included in the bid package for reference only and will be part of a separate contract.**

**SECTION 2: SPECIAL PROVISIONS**

The requirements set forth in these “Special Provisions” shall be used in addition to those set forth in “Standard Specifications for Public Works Construction”.

**SECTION 3: PREBID CONFERENCE**

A non-mandatory Pre-Bid conference will be held at the jobsite located at 6963 Sheidbar Road on Wednesday, January 17, 2024, at 10:00 A.M.

**SECTION 4: NOTICE TO PROCEED AND TIME SCHEDULE**

An official "Notice to Proceed" specifying the date by which construction operations shall be started will be issued in writing and delivered to the CONTRACTOR by the City at the Pre-construction Meeting. Contract time will begin on the date specified in the "Notice to Proceed", unless operations begin at an earlier date, in which case the date that such operations begin will apply. The CONTRACTOR shall immediately begin and diligently prosecute the work to completion. The CONTRACTOR shall oblige himself to complete the work within the stated time limits. All work described in this document shall be completed within four hundred eighty (480) calendar days from the time of issuance of the Notice to Proceed. **Refer to Section 20 of these “Special Provisions” for phasing requirements.**

**SECTION 5: LIQUIDATED DAMAGES**

In case all work called for under the contract is not completed before or upon the expiration of the time limits set forth above, it is agreed by the parties to the contract that damage will be sustained by the City and that it will be impracticable to determine accurately the actual damage the City will sustain in the event of any such delay. Therefore, the CONTRACTOR shall pay to the City:

- FIVE HUNDRED DOLLARS (\$500.00) for each and every calendar day delay after the four hundred eighty (480) calendar day completion time limit.

In finishing the work in excess of the dates prescribed and the City shall further have the right to charge to the CONTRACTOR, his heirs, assigns or sureties and to deduct from the final payment for the work, all or any part as it may deem proper of the actual cost of which are directly chargeable to the contract and which accrue during the period of such extensions, except that the cost of the final surveys and preparation of final estimate shall not be included in such charges.

The City may deduct this amount from any money due or that may become due the CONTRACTOR under the contract. This payment shall not be considered as a penalty, but as liquidated damages suffered by the City on account of the failure of the CONTRACTOR to complete the work within the time limit of the contract.

#### **SECTION 6: EXCUSABLE DELAYS**

The CONTRACTOR shall not be assessed with liquidated damage nor the cost of the Project Manager and inspection during any delay in the completion of the work caused by acts of God, the public enemy, fire, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or due to such causes, provided that the CONTRACTOR shall within ten (10) days from the beginning of such delay notify the Project Manager in writing of the causes of delay. The Project Manager's findings of the facts thereon shall be final and conclusive.

#### **SECTION 7: INTENT OF THE PLANS AND SPECIFICATIONS**

The intent of the plans and specifications is to prescribe a complete outline of work, which the CONTRACTOR undertakes to do in full compliance with the contract.

The CONTRACTOR shall furnish all required materials, equipment, tools, labor and incidentals, unless otherwise provided in the contract and shall include the cost of these items in the contract unit prices for the several units of work. All items of work called for on the plans or in the specifications and not included as a separate item in the proposal shall be considered as incidental to the other items listed in the proposal and the payment for such incidental items shall be considered as included in the contract unit prices bid.

#### **SECTION 8: AUTHORITY OF THE PROJECT MANAGER AND INSPECTOR**

All work shall be done under the supervision of the Project Manager acting on behalf of the City. The Project Manager shall decide all questions that arise as to the quality and acceptability of materials furnished, work performed, manner of performance, rates of progress, interpretation of the plans and specifications, acceptable fulfillment of the contract and compensation under the specifications. He shall determine the amount of work performed and materials furnished, and his decision and estimate shall be final. The Project Manager's estimate shall be "condition precedent" to the right of the CONTRACTOR to receive money due him under the contract. The Project Manager does not have authority to authorize changes in plans and specifications without prior written approval of the Engineer.

The City shall provide an inspector who will represent the City and shall make inspections of all work, sample and test materials and do such other work relative to supervision of the project as he may be assigned by the City. All instructions given by the inspector are subject to approval by the Project Manager. The Contractor shall take direction **only** from the Project Manager and Inspector.

**SECTION 9: CHANGE ORDERS**

The City of Sparks reserves the right to make alterations or supplements to the Contract. Change Order Forms are required for all changes in decreases and/or increases of quantities and/or dollar amount changes in accordance with the Standard Specifications and required by the City of Sparks.

**SECTION 10: COOPERATION WITH OTHER CONTRACTORS**

The CONTRACTOR shall cooperate with other CONTRACTOR's who may be employed by the City on construction of other work adjacent to or in proximity of the location of the project.

**SECTION 11: DISPOSAL OF EXCESS AND WASTE MATERIALS**

Trash, construction debris, cleared vegetation, excavated material unsuitable to be incorporated in the construction shall become the property of the CONTRACTOR and shall be removed by the CONTRACTOR and shall be legally disposed of offsite in accordance with all federal, state and local regulations.

**SECTION 12: LIMITS OF CONTRACTOR'S OPERATIONS**

If the CONTRACTOR's operations result in damage to any publicly or privately owned facilities outside the limitations of the construction easement, the CONTRACTOR shall, at his expense, repair such damage or indemnify the owner of the damaged property.

At no time will the CONTRACTOR be allowed to store debris or materials on the street overnight. Materials will be allowed to be stored onsite with the approval of the Project Manager.

**SECTION 13: MEASUREMENT FOR PAYMENT**

The total amount payable under this contract shall be determined by the percentage of the work performed and determined from unit prices as furnished by the CONTRACTOR in the schedule of prices contained in his proposal. The percentage of work shall be determined by the Project Manager.

**SECTION 14: PRECONSTRUCTION CONFERENCE**

After the execution of the contract, but prior to the commencement of any work, a preconstruction conference between the CONTRACTOR and the city will be held at a mutually acceptable time and place.

**SECTION 15: WORKING DAY, WORK HOURS, SATURDAY, SUNDAY, HOLIDAY AND OVERTIME WORK**

The CONTRACTOR's normal working hours shall be from 7:00 A.M. until 7:00 P.M., Monday through Friday unless otherwise required by these specifications or approved in writing by the City Project Manager when requested in writing by the CONTRACTOR. The CONTRACTOR shall not commence Construction operations before seven o'clock (7:00 A.M. Pacific Time) each working day except as directed by the City Project Manager and as specified herein.

The CONTRACTOR shall not perform any contract work on Saturday, Sunday, legal Holidays and outside of the twelve (12) hours available during a regular working day except as directed and/or approved by the city Project Manager and as specified herein.

If the CONTRACTOR plans to perform work outside of the twelve (12) hours available during a regular working day, the CONTRACTOR shall first obtain approval from the City Project Manager at least twenty-four (24) hours prior to commencing such overtime work. If the CONTRACTOR plans to perform work on Saturday or Sunday, he/she shall obtain approval by the Thursday prior to work on the Saturday or Sunday for which work is planned. If the CONTRACTOR plans to perform work on a legal Holiday, he/she shall first obtain approval from the City Project Manager at least 48 hours in advance.

The CONTRACTOR shall be charged for all of City of Sparks' employee(s) time spent for overtime, Saturday, Sunday or Holiday work, based on the employee's hourly rate, plus benefits. The CONTRACTOR will be notified of the costs incurred and if the payment is not made, such costs will be deducted from any payment due to the CONTRACTOR.

The City of Spark recognizes the following legal Holidays:

January 1	New Year's Day
3 <sup>rd</sup> Monday in January	Martin Luther King, Jr. Birthday
3 <sup>rd</sup> Monday in February	President's Day
Last Monday in May	Memorial Day
Third Monday in June	Juneteenth
July 4	Independence Day
1 <sup>st</sup> Monday in September	Labor Day
Last Friday in October	Nevada Day
November 11	Veteran's Day
4 <sup>th</sup> Thursday in November	Thanksgiving Day
4 <sup>th</sup> Friday in November	Family Day (day after Thanksgiving)
December 25	Christmas Day

#### **SECTION 16: SUBMITTALS**

Submittals for the following items shall be provided at the time of the preconstruction meeting. Submittals shall be submitted by electronic pdf. This is a partial list of submittal items. All items outlined in the plans and bid specifications required for completion of the project shall be submitted and approved prior to purchasing or installing.

- Construction schedule
- Generator
- Exhaust System
- Plumbing
- Mechanical
- Landscaping
- Electrical wiring, conduit, circuit breakers, etc.
- Ceiling tiles, sheet rock, paint, etc.
- Finish materials
- Concrete mix design
- Structural steel

#### **SECTION 17: CLEANUP AND DUST CONTROL**

At completion of the workday, the Contractor shall clean up all waste material, excess materials, and trash.

#### **SECTION 18: FORCE ACCOUNT**

Force Account items as defined by the City of Sparks will be additions to the contract arising within the course and scope of the contract for incidental costs due to unforeseen circumstances.

Any force account items shall be adjusted daily upon report sheets, furnished to the Project Manager by the CONTRACTOR and signed by both parties. These daily reports shall thereafter be considered the

true record of force account items for unforeseen circumstances. No additional incidental work shall be performed or made except upon a written order from the Project Manager.

**SECTION 19: INSURANCE AND INDEMNIFICATION**

The CONTRACTOR shall not commence any work nor permit a Subcontractor to commence work on this project until satisfactory proof has been presented to the City of Sparks Purchasing Division that all insurance requirements as outlined by the City have been met.

The CONTRACTOR shall provide and maintain, during the effective life of the awarded contract, Comprehensive General Liability Insurance covering the CONTRACTOR and the City of Sparks.

**BID ITEM CLARIFICATIONS  
FIRE STATION #6 CONSTRUCTION PROJECT  
BID #23/24-005  
PWP #WA-2024-131**

**BASE BID ITEMS**

**Bid Item 1: Construction of a new Fire Station in north Sparks**

The unit price bid for this item shall include the construction of a new fire station in north sparks which includes the development of the parcel, grading, landscaping, sewer, storm drain, paving, concrete, masonry, framing, a new generator, plumbing, mechanical, electrical, exhaust system, compressed air system, and final sprinkler design package, including all labor, equipment, materials and necessary incidentals.

This item shall include all associated work, as shown on the plans and bid specifications, including all labor, equipment, materials, and all necessary incidentals to complete the work. This item shall be on a per lump sum basis.

**The NV Energy, TMWA and mass grading plans have been included in the bid package for reference only and will be part of a separate contract.**

See Plans and Specifications.

**Bid Item 2: Force Account**

A force account has been established for this project and shall be included in each bid. The force account will be utilized only as necessary for extra work authorized and approved in advance by the City of Sparks representative as per Special Provision Section 18.

Contractor shall refer to Special Provision Section 18.



**Specification Project Manual**  
**Volume 1**  
**City of Sparks Fire Station #6**  
**for**  
**City of Sparks Community Services**



**Bid Set**  
**Issue Date: January 04, 2024**

PREPARED BY

**tsk**

**TSK Architects**

225 Arlington, Suite A • Reno NV 89501

775.857.2949

TSK Project No.: 22-043.00



**City of Sparks - Fire Station #6**

**SECTION 00 0102  
PROJECT INFORMATION**

**PART 1 GENERAL**

**1.1 PROJECT IDENTIFICATION**

- A. Project Name: City of Sparks - Fire Station #6.
- B. TSK Project No: 22-043.00.
- C. Project Location:  
6963 Scheidbar Road.  
Sparks, NV 89436.
- D. The Owner, hereinafter referred to as Owner: City of Sparks Community Services
- E. Owner's Project Manager: Brian D. Cason, S.E., P.E..
  - 1. Phone/Fax: O: 775.353.4083 - M: 775.376.2513.
  - 2. E-mail: bcason@cityofsparks.us.

**1.2 PROJECT DESCRIPTION**

- A. Summary Project Description:
  - 1. The New Fire Station #6 for the City of Sparks Fire Department provide expanded coverage for the general vicinity between Pyramid Way and the Red Hawk Golf & Resort, north of Los Altos Parkway and South of La Posada Drive. This 14,072sf, single-story, Type II-B Public Facility is located at the southwest corner of the Rolling Meadows round-about. It is expected that this facility will serve this region for the next 30+ years.
  - 2. The facility is oriented east-west to maximize environmental control and is divided into 3 main components: main building (office & residential functions), apparatus bay (enclosed garage bays for fire apparatus), and apparatus support (technical spaces). This station is designed to support 9 crew members per shift and house up to 6 fire apparatus within the bays. On-site vehicle cleaning occurs within the bays and trench drains will be connected to a sand-oil interceptor.
  - 3. Public access to the facility is limited to the main entry vestibule for security and staff can access the facility through designated secure doorways. The primary fire truck access is located along the eastern edge of the property, and it is anticipated that the main points of utility connections will be located in this zone as well. Initial turning-radii studies account for vehicles up to the size of a ladder truck but actual vehicle designations for this station are still under review as noted on the architectural site plan. Staff and visitor parking are co-located along the north portion of the site to serve as a buffer between the round-about and the fire station.
  - 4. Mechanical equipment is primarily located at the ground level and will be on the rear (west) of the facility and will be screened by a decorative fence. The materiality of the structure is primarily composed of mixed-size CMU block, with corrugated metal, EIFS, and phenolic panel

## City of Sparks - Fire Station #6

accents. Each elevation is articulated using recessed windows and doorways, as depicted in the building elevations.

B. Contract Scope: Construction, demolition, and renovation.

C. Contract Terms: Lump sum (fixed price, stipulated sum).

### 1.3 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Architect: TSK Architects.

1. Architect's Project Manager: Kolby Harpstead.

2. Address: 225 S. Arlington Avenue | Suite A

3. City, State, Zip: Reno, NV 89501

4. Phone/Fax: 702.857.2403.

5. E-mail: kolby.harpstead@tska.com

### 1.4 PROCUREMENT TIMETABLE

A. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

### 1.5 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:

1. From Owner at the Project Manager's address listed above.

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION (NOT USED)

END OF SECTION 00 0102

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**SECTION 00 0110  
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**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

- 00 0001 - Project Title Page
- 00 0102 - Project Information
- 00 0007 - Seals Page, Not Included with this Submittal.
- 00 0110 - Table of Contents

**DIVISION 01 - GENERAL REQUIREMENTS -**

- 01 2500 - Substitution Procedures
- 01 2600 - Contract Modification Procedures
- 01 2613 - Request for Information (RFI)
- 01 3000 - Administrative Requirements
- 01 3216 - Construction Progress Schedule
- 01 3300 - Submittal Requirements
- 01 4000 - Quality Requirements
- 01 4216 - Definitions
- 01 5000 - Temporary Facilities and Controls
- 01 6000 - Product Requirements
- 01 7300 - Execution Requirements
- 01 7329 - Cutting and Patching
- 01 7800 - Closeout Procedures and Submittals
- 01 7836 - Warranties and Bonds
- 01 7900 - Demonstration and Training
- 01 9113 - General Commissioning Requirements

**DIVISION 02 -- EXISTING CONDITIONS**

For Site Preparation and Earthwork, see Division 31

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For Pavements and Site Improvements, see Division 32

For Site Utilities, see Division 33

### **DIVISION 03 - CONCRETE-**

03 3000 - Cast-In-Place Concrete

03 3511 - Concrete Floor Finishes

### **DIVISION 04 - MASONRY-**

04 2000 - Unit Masonry

### **DIVISION 05 - METALS -**

05 1200 - Structural Steel Framing

05 2100 - Steel Joist Framing

05 3100 - Steel Decking

05 4000 - Cold Formed Metal Framing

05 5000 - Metal Fabrications

05 5133 - Metal Ladders

### **DIVISION 06 - WOOD, PLASTICS AND, COMPOSITES -**

06 1000 - Rough Carpentry

06 4100 - Architectural Wood Casework

06 6400 - Fiber Reinforced Plastic (FRP) Paneling

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### **DIVISION 07 - THERMAL AND MOISTURE PROTECTION -**

07 2100 - Building Insulation

07 2726 - Fluid Applied Membrane Air Barrier

07 4619 - Corrugated Metal Panels

07 5419 - Single Ply Membrane Roofing

07 6200 - Sheet Metal Flashing and Trim

07 7113 - Pre-Manufactured Metal Coping and Edge Systems

07 7200 - Roof Accessories

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07 8400 - Firestopping

07 9200 - Joint Sealants

**DIVISION 08 - OPENINGS -**

08 1113 - Hollow Metal Doors and Frames

08 1416 - Flush Wood Doors

08 3100 - Access Doors and Panels

08 3223 - Folding Glazed Walls and Doors

08 3613 - Sectional Overhead Doors

08 4313 - Aluminum Entrances and Storefronts Systems

08 3615 - Four-Fold Door Systems

08 3616 - Barn (Sliding) Door

08 6223 - Tubular Skylights

08 7100 - Door Hardware

08 8000 - Glass and Glazing

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09 0561 - Common Work Results for Flooring Preparation

09 2116 - Gypsum Board Assemblies

09 2216 - Non-Structural Metal Framing

09 5100 - Suspended Acoustical Ceilings

09 6500 - Resilient Flooring, Wall Base and Accessories

09 6723 - Resinous Flooring

09 6813 - Tile Carpeting

09 7213 - Digital Printed Vinyl Wallcovering Murals

09 9000 - Painting and Coating

09 9600 - Anti-Graffiti Coatings

**DIVISION 10 - SPECIALTIES -**

10 1400 - Signage

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10 2239 - Folding Panel Partitions

10 2601 - Wall and Corner Guards

10 2800 - Toilet Room Accessories

10 4313 - Automated External Defibrillator AED & Cabinet

10 4400 - Fire Protection Specialties

10 7500 - Flagpoles

**DIVISION 11 - EQUIPMENT - (NOT USED)**

**DIVISION 12 - FURNISHINGS -**

12 2400 - Window Shades

**DIVISION 21 - FIRE SUPPRESSION -**

**DIVISION 22 - PLUMBING -**

22 0500 - Basic Plumbing Requirements

22 0503 - Through Penetration Firestopping

22 0513 - Motors

22 0516 - Plumbing Expansion Compensation

22 0529 - Plumbing Supports and Anchors

22 0548 - Plumbing Vibration Isolation

22 0550 - Seismic Requirements for Equipment and Supports

22 0553 - Plumbing Identification

22 0716 - Plumbing Equipment Insulation

22 0719 - Plumbing Piping Insulation

22 0800 - Commissioning of Plumbing

22 0801 - Commissioning of Plumbing

22 1016 - Plumbing Piping

22 1023 - Natural Gas and Propane Piping

22 1030 - Plumbing Specialties

22 1519 - Compressed Air Systems

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22 3000 - Plumbing Equipment

22 4000 - Plumbing Fixtures

**DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC) -**

23 0500 - Basic HVAC Requirements

23 0503 - Through Penetration Firestopping

23 0513 - Motors

23 0515 - Variable Frequency Drives

23 0516 - HVAC Expansion Compensation

23 0529 - HVAC Supports and Anchors

23 0548 - HVAC Vibration Isolation

23 0550 - Seismic Requirements for Equipment and Supports

23 0553 - HVAC Identification

23 0593 - Testing, Adjusting, and Balancing

23 0713 - Duct Insulation

22 0716 - HVAC Equipment Insulation

23 0719 - HVAC Piping Insulation

23 0800 - Commissioning of HVAC

23 0900 - Controls

23 2123 - HVAC Pumps

23 2300 - Refrigeration Piping and Specialties

23 3100 - Ductwork

23 3300 - Ductwork Accessories

23 3416 - Centrifugal Fans

23 3423 - Power Ventilators

23 3501 - Vehicle Exhaust Extraction Rail System

23 3502 - Vehicle Exhaust Extraction Tract System

23 3700 - Air Inlets and Outlets

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- 23 4000 - Air Cleaning
- 23 5100 - Breechings, Chimneys, and Stacks
- 23 5400 - Forced Air Furnaces
- 23 7423 13 - Gas Fired Make-Up Air Units
- 23 7513 - Packaged Water Source Dedicated Outside Air Handling Units
- 23 8126 - Split-system Air Conditioning Units
- 23 8145 - Variable Refrigerant Flow Heat Pumps

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- 26 0503 - Through Penetration Firestopping
- 26 0513 - Wire and Cable
- 26 0517 - Electrical Heat Trace and Snow Melt
- 26 0523 - Manufactured Wiring Systems
- 26 05 26 - Grounding and Bonding
- 26 0527 - Supporting Devices
- 26 0533 - Surface Raceways
- 26 0542 - Equipment Wiring Systems
- 26 0548 - Seismic Requirements for Equipment and Supports
- 26 0553 - Electrical Identification
- 26 0916 - Electrical Controls and Relays
- 26 0933 - Lighting Control Systems
- 26 2000 - Service Entrance
- 26 2413 - Switchboards
- 26 2416 - Panelboards
- 26 2716 - Cabinets and Enclosures
- 26 2726 - Wiring Devices
- 26 2813 - Fuses



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26 3213 - Packaged Engine Generator Systems

26 3353 - Static Uninterruptable Power Supply

26 3600 - Transfer Switches

26 4300 - Surge Protection Devices

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**DIVISION 27 – COMMUNICATIONS -**

27 0500 - Basic Communications Systems Requirements

27 0503 - Through Penetration Firestopping

27 0526 - Communications Bonding

27 0528 - Interior Communication Pathways

27 0543 - Exterior Communication Pathways

27 0553 - Identification and Administration

27 1100 - Coimmunication Equipment Rooms (CER)

27 1300 - Backbone Cabling Requirements

27 1500 - Horizontal Cabling Requirements

27 1710 - Testing

27 1720 - Structured Cabling System Warranty

**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY -**

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**SECTION 01 2500  
SUBSTITUTION PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Administrative and procedural requirements for substitutions.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Project meetings, photographs, documentation, reports, and drawing coordination.
- B. Section 01 3300 - Submittal Requirements: Submittal procedures.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling and requirements for submitting comparable product submittals for products by listed manufacturers.

**1.3 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Substitution Requests: Submit (1) electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- C. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
  - 1. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
  - 2. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate Contractors, that will be necessary to accommodate proposed substitution.

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3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- D. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- E. Samples, where applicable or requested.
- F. Certificates and qualification data, where applicable or requested.
- G. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- H. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- I. Research reports evidencing compliance with building code in effect for Project, and applicable code organization.
- J. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- K. Cost information, including a proposal of change, if any, in the Contract Sum.
- L. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- M. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

### 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

### 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

#### Substitution Procedures - 01 2500

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- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
  - b. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - c. Requested substitution does not require extensive revisions to the Contract Documents.
  - d. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - e. Substitution request is fully documented and properly submitted.
  - f. Requested substitution will not adversely affect Contractor's construction schedule.

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- g. Requested substitution has received necessary approvals of authorities having jurisdiction.
- h. Requested substitution is compatible with other portions of the Work.
- i. Requested substitution has been coordinated with other portions of the Work.
- j. Requested substitution provides specified warranty.
- k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

### **PART 3 - EXECUTION**

#### **3.1 SUBSTITUTION SUBMITTAL PROCEDURES**

- A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- B. Substitution request must be completed with all required information. Incomplete substitution requests will be returned with no action taken.
- C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- D. Submit 1 copy (electronic) of request for substitution for consideration. Limit each request to one proposed substitution.
- E. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
- F. Substitution request does not replace the required submittal. Submittals for any items accepted through the Substitution Request procedure are still required.

#### **3.2 ARCHITECTS ACTION**

- A. If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution.
- B. Architect will notify Contractor of acceptance or rejection of proposed substitution within:
  - 1. 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- C. Forms of Acceptance:
  - 1. Architect's Supplemental Instructions (ASI) for minor changes in the Work.
  - 2. Notice of Clarifications (NOC).
  - 3. Construction Change Directive:

### **Substitution Procedures - 01 2500**

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- a. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change for subsequent inclusion in a Change Order.
- b. Documentation will describe changes in Work and designate method of determining any change to Contract Sum or Contract Time. Promptly execute change.

### 4. Change Orders:

- a. AIA Document G701.

D. The Architect will notify Contractor in writing of decision to accept or reject request.

### 3.3 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Procedures and Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

**END OF SECTION 01 2500**

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**SECTION 01 2600  
CONTRACT MODIFICATION PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

**1.2 RELATED SECTIONS :**

- A. Section 01 25 00 - Substitution Procedures: For administrative procedures for handling requests for substitutions made after Contract award.

**1.3 DEFINITIONS**

- A. Modification: A Modification is defined as one of the following:
  1. An Architect's Supplemental Instruction; (ASI)
  2. Notice of Clarification; (NOC)
  3. A Change Order; (CO)
  4. A Construction Change Directive; (CCD)
  5. Or a written amendment to the Contract signed by Owner, Architect, and Contractor.

**1.4 MINOR CHANGES IN THE WORK**

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time in the form of an ASI.

**1.5 CHANGE ORDER REQUESTS**

- A. Owner-Initiated Change Order Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  2. Within 10 days after receipt of Change Order Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
  3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  5. Include costs of labor and supervision directly attributable to the change.

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6. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a Change Order Request to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Section 01 25 00 - Substitution Procedures if the proposed change requires substitution of one product or system for product or system specified.

### 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Change Order Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

### 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Change Orders may only be approved if the Architect agrees and signs the Change Order form.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

### 1.8 OVERHEAD AND PROFIT FEES APPLICABLE FOR CHANGES IN THE WORK:

- A. Refer to Conformed General Conditions of the Contract for Construction.
1. The cost of the Work is defined as the cost of labor and materials only.
    - a. For work performed by the Contractor's own forces - ten percent (10%) of the cost of labor and materials over \$10,000 dollars.
    - b. For the work performed by the Subcontractors - the Contractor is allowed - five percent (5%) of the cost of the work performed by the Subcontractor over \$10,000 dollars.

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- c. For work performed by the Subcontractor's own forces - the Subcontractor is allowed ten percent (10%) of the cost of labor and materials over \$10,000 dollars.
- d. The overhead and profit allowed above shall include the cost of all bonds and insurance.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION 01 2600**

**Contract Modification Procedures - 01 2600**

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**SECTION 01 2613  
REQUEST FOR INFORMATION**

**PART 1 GENERAL**

**1.1 SUMMARY**

A. Section Includes: Requirements for Request for Information / Interpretation (RFI).

**1.2 DEFINITIONS**

A. Request For Information / Interpretation (RFI):

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
2. A properly prepared Request for Information / Interpretation shall include a detailed written statement that indicates the specific Drawing or Specification in need of clarification and the nature of the clarification requested.
  - a. Prepare using an electronic version of the Document 006313 - Request for Information Form. Each page of attachments to the RFI shall bear the RFI number at the upper left corner. OR
    - 1) Use AIA G716 - Request for Information . OR
    - 2) Use CSI/CSC Form 13.2A - Request for Interpretation.
  - b. Drawings shall be identified by sheet number and detail number or location on the drawing sheet.
  - c. Specifications shall be identified by section number, article, paragraph and page number.
3. Requests for Information: Request made by Contractor concerning items not indicated on drawings or contained in Project Manual that is necessary to properly perform the work.
4. Requests for Interpretation: Request made by Contractor in accordance with Owner's Representative's third party obligations to the contract for construction.
5. Clouding of the specific item on a drawing or within the specification in question is expected.

B. Improper RFI's: RFI's that are not properly prepared will be returned without review.

C. Frivolous RFI's:

1. RFI's that request information that is clearly shown on the Contract Documents.
2. Frivolous RFI's may be returned unanswered or may be processed by the Architect at the Architect's standard hourly rate. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Owner and Contractor will be notified by the Architect prior to the processing of frivolous RFI's.

**1.3 CONTRACTOR'S REQUESTS FOR INFORMATION**

**Request for Information - 01 2613**

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- A. RFI's shall be originated by the Contractor and is responsible for reviewing, numbering sequentially, and forwarding all RFI's to the Architect of Record with one (1) copy to Owner.
1. RFI's from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by the Contractor prior to submittal to the Architect.
  2. RFI's from subcontractors or material suppliers sent directly to the Owner's Representative, Architect or the Architect's consultants shall not be accepted.
- B. Content of the RFI:
1. Forms shall be completely filled in, all request shall be typed.
  2. Include a detailed, legible description of item needing interpretation and the following:
    - a. Project Name.
    - b. Date.
    - c. Name of Contractor, and authoring company.
    - d. Name of Architect or Engineer.
    - e. RFI number.
      - 1) RFI's shall be submitted in numerical order with no breaks in the consecutive numbering.
      - 2) Each page of attachments to RFI's shall bear the RFI number and shall be consecutively numbered in chronological order.
      - 3) If an RFI is resubmitted, it **MUST** have the same number as the original RFI with a suffix identifying it as a resubmittal, for example RFI-002-1, RFI-002-A, or RFI-002-R1.
    - f. Specification Section number and title and related paragraphs, as appropriate.
    - g. Drawing number and detail references, as appropriate.
    - h. Field dimensions and conditions, as appropriate.
    - i. Contractor's suggested solution(s):
      - 1) If Contractor's solution(s) impact the Contract Time, Contractor shall state impact in the RFI.
      - 2) All RFI's must have potential schedule and budget impact noted, when applicable.
    - j. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - k. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

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- C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
  - 1. Attachments shall be electronic files in Adobe Acrobat or BlueBeam PDF format.
- D. RFI's may be submitted by Email.
  - 1. Address for Email will be distributed by the Architect at the PreConstruction Conference.
- E. When the Contractor is unable to determine from the Contract Documents, the material, process or system to be installed, the Architect shall be requested to make a clarification of the indeterminate item as follows:
  - 1. Contractor shall prepare and submit an RFI to the Architect of Record with one (1) copy to Owner.
  - 2. RFI's may not be sent directly to the Architect's Consultants. All RFI's shall be sent directly to the Architect.
  - 3. Non-compliance Reports, Inspection Reports, Substitution Requests, Submittal Requests and Confirmations shall not be submitted as an RFI.
- F. Contractor shall carefully study the Contract Documents to assure that the requested information is not available therein. RFI's which request information available in the Contract Documents will be deemed either "improper" or "frivolous" as noted above.
- G. Contractor shall endeavor to keep the number of RFI's to a minimum.
- H. In cases where RFI's are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically and similar items, the Contractor shall prepare a complete layout of a suggested solution using drawings or sketches drawn to scale, and submit same with the RFI. RFI's which fail to include a suggested solution will be returned unanswered with a requirement that the Contractor submit a complete request.
- I. RFI's shall NOT be used for the following purposes:
  - 1. To request approval of submittals
  - 2. To request approval of substitutions,
  - 3. To request changes which are known to entail additional cost or credit.
  - 4. To request different methods of performing work other than those drawn and specified.
  - 5. To request additional time to be added to the Project schedule.
- J. In the event the Contractor believes that an RFI response by the Architect results in additional cost or time, Contractor shall not proceed with the work indicated by the RFI until a Construction Change Directive (CCD) is prepared and approved. RFI's shall not automatically justify a cost increase in the work or a change in the project schedule.
  - 1. Answered RFI's shall not be construed as an approval to perform the additional work.

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2. Unanswered RFI's will be returned with a stamp or notation "Not Reviewed".
- K. Contractor shall prepare and maintain a log of RFI'S, and at any time requested by the Architect and Owner, Contractor shall furnish copies of the log showing outstanding RFI'S. Contractor shall note unanswered RFI's in the log. Logs shall be reviewed as part of weekly construction meetings.
- L. It is the Contractor's responsibility to allow for a reasonable review period for each RFI. Unless an expedited review is requested and agreed upon by the Owner's Representative, Architect of Record and the Contractor prior; Contractor shall allow no less than 7 Working days review and response time for RFI'S.
  1. RFI's shall state requested date/time for response. However, this requested date/time for response is not a guarantee that the RFI will be answered by that date/time if that date/time is too expeditious.

### 1.4 ARCHITECT'S RESPONSE TO RFI'S

- A. Review Time: Architect will respond and return RFIs to Contractor within seven Working days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
  1. Architect may determine that additional time is required to respond, and notify contractor in writing of additional days required.
  2. If a review is required of multiple consultants, then the review and response period shall be 10 Working days.
  3. The Architect will endeavor to respond in a timely fashion to RFI's.
  4. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- B. Architect will respond to RFI's on one of the following forms:
  1. Properly prepared RFI's:
    - a. Response directly upon Request for Information / Interpretation form.
      - 1) Response to properly prepared RFI's may or may not be made directly upon the RFI form as deemed appropriate by the Architect.
    - b. Architect's Supplemental Instruction (ASI).
    - c. Request for Proposal (RFP).
    - d. Construction Change Directive (CCD).
  2. Improper or Frivolous RFI's:
    - a. Notification of Processing Fee(s).
    - b. Unanswered RFI's will be returned with a stamp or notation: "Not Reviewed".

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**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION 01 2613**

**Request for Information - 01 2613**

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**SECTION 01 3000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Project Meetings
  - 1. Preconstruction meeting.
  - 2. Site mobilization meeting.
  - 3. Preinstallation Meetings.
  - 4. Progress meetings.
- B. Progress Photographs.

**1.2 PROJECT COORDINATION**

- A. Owner's Representative: Brian D. Cason, S.E., P.E..
- B. Cooperate with the Owner's Project Manager in allocation of mobilization areas of site; for field offices and sheds, for Site access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Manager.
- D. Comply with Project Manager's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Manager for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Manager.
- G. Make the following types of submittals to Architect with copies to Project Manager.
  - 1. Requests for interpretation/information.
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Progress schedules.
  - 7. Coordination drawings.

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8. Closeout submittals.
- H. Make the following types of submittals to Project Manager.
  1. Change order requests.
  2. Progress schedules.

**PART 2 PRODUCTS - NOT USED.**

**PART 3 EXECUTION**

**3.1 PRECONSTRUCTION MEETING**

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
  1. Owner.
  2. Architect.
  3. Project Manager.
  4. General Contractor / Construction Manager.
  5. Sub-Contractors.
  6. Special Consultants.
  7. Others that are deemed necessary by Owner, Architect and General Contractor.
- C. Agenda:
  1. Submission of executed bonds and insurance certificates.
  2. Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.



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- i. Procedures for Submittals.
  - j. Preparation of Record Documents.
  - k. Preparation of operating and maintenance manuals.
  - l. Use of the premises and existing building.
  - m. Work restrictions.
  - n. Owner's occupancy requirements.
  - o. Responsibility for temporary facilities and controls.
  - p. Construction waste management and recycling.
  - q. Parking availability.
  - r. Office, work, and storage areas.
  - s. Equipment deliveries and priorities.
  - t. First aid.
  - u. Security.
  - v. Progress cleaning.
  - w. Working hours.
  - x. Distribution of Contract Documents.
- 3. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 4. Designation of personnel representing the parties to Contract, Owner, and Architect of Record of Record.
  - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 6. Special requirements.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Project Manager, participants, and those affected by decisions made.

### 3.2 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Preinstallation Meetings: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

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1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect 1 week (7 days) in advance of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
  - a. The Contract Documents.
  - b. Options.
  - c. Related RFIs.
  - d. Related Change Orders.
  - e. Purchases.
  - f. Deliveries.
  - g. Submittals.
  - h. Review of mockups.
  - i. Possible conflicts.
  - j. Trade responsibilities.
  - k. Compatibility problems.
  - l. Time schedules.
  - m. Weather limitations.
  - n. Manufacturer's written recommendations.
  - o. Warranty requirements.
  - p. Compatibility of materials.
  - q. Acceptability of substrates.
  - r. Temporary facilities and controls.
  - s. Space and access limitations.
  - t. Regulations of authorities having jurisdiction.
  - u. Testing and inspecting requirements.
  - v. Installation procedures.
  - w. Coordination with other work.

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- x. Required performance results.
  - y. Protection of adjacent work.
  - z. Protection of construction and personnel.
- C. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- D. Reporting: Record minutes of the meeting.
- 1. Distribute copies within two days after meeting to participants, with 1 copy to Architect, Owner, participants, and those affected by decisions made.
- E. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

### 3.3 PROGRESS MEETINGS

- A. Project Manager shall schedule and administer meetings throughout progress of the Work.
- B. Project Coordinator shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major SubContractors and suppliers, Owner, Architect, others as appropriate to agenda topics for each meeting.
- D. Agenda:
- 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of off-site fabrication and delivery schedules.
  - 7. Maintenance of progress schedule.
  - 8. Corrective measures to regain projected schedules.
  - 9. Planned progress during succeeding work period.
  - 10. Coordination of projected progress.
  - 11. Maintenance of quality and work standards.
  - 12. Effect of proposed changes on progress schedule and coordination.

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13. Other business relating to Work.
  - E. Record minutes and distribute copies within 5 days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
  - F. An electronic copy of the meeting minutes as well as the current submittal schedule, submittal log and RFI log must be submitted after each meeting. This upload must occur within one (1) business day following the end of the progress meeting.
    1. When submitted electronically the meeting minutes and supplemental logs must be in Portable Document Format (.pdf)
      - a. Prepare file for submittal by converting it to PDF using Adobe Acrobat or BlueBeam Revu, latest version. Legible scanned PDF files of plain paper documents are acceptable, but PDF sets created by electronically converting files using Adobe Acrobat or BlueBeam Revu are preferable. Scanned documents are more difficult to annotate, are usually less legible, and produce larger attachment sizes.

### 3.4 CONSTRUCTION PROGRESS SCHEDULE.

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

### 3.5 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Submit new photographs at least once a month, within 3 days after exposure.
- C. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- D. Photography Type: Digital; electronic files.
- E. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.
- F. In addition to periodic, recurring views, take photographs of each of the following events:

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1. Completion of site clearing.
2. Excavations in progress.
3. Foundations in progress and upon completion.
4. Underground utility lines.
5. Utility lines running below slab on grade.
6. Structural framing in progress and upon completion.
7. Enclosure of building, upon completion.
8. Final completion, minimum of ten (10) photos.

### G. Views:

1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
2. Provide non-aerial photographs from four cardinal views at each specified time, until Date of Substantial Completion.
3. Consult with Architect for instructions on views required.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

### H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.

1. Delivery Medium: On photo CD.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

**END OF SECTION 01 3000**

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**SECTION 01 3216  
CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

**1.2 RELATED SECTIONS**

- A. Section 01 1000 - Summary: Work sequence.

**1.3 REFERENCE STANDARDS**

- A. AGC (CPSM) - Construction Planning and Scheduling Manual 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM 2015.

**1.4 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit in PDF format.

**1.5 QUALITY ASSURANCE**

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

**1.6 SCHEDULE FORMAT**

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.

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- D. Scale and Spacing: To allow for notations and revisions.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.1 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

#### **3.2 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- F. Indicate delivery dates for owner-furnished products.
- G. Provide legend for symbols and abbreviations used.

#### **3.3 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

#### **3.4 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

#### **3.5 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.

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- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

**3.6 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

**END OF SECTION 01 3216**



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**SECTION 01 3300  
SUBMITTAL REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Submittals:
  - 1. Submittal Schedule.
  - 2. Submittals for Review.
  - 3. Submittals for Information.
  - 4. Submittals for Project Closeout.
  - 5. Number of copies of submittals.
  - 6. Submittal procedures.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary:
- B. Section 012500 - Short-Circuit Studies: For Substitution Requests.
- C. Section 01 6000 - Product Requirements: for requirements for submitting comparable product submittals for products by listed manufacturers.
- D. Section 01 7300 - Execution Requirements:
- E. Section 01 7800 - Closeout Procedures and Submittals
- F. Section 01 7836 - Warranties and Bonds: Additional procedures for submittals relating to commissioning.
  - 1. Where submittals are indicated for review by both Architect and the Commissioning Authority, submit one extra and route to Architect first, for forwarding to the Commissioning Authority.
  - 2. Where submittals are not indicated to be reviewed by Architect, submit directly to the Commissioning Authority; otherwise, the procedures specified in this section apply to commissioning submittals.

**PART 2 PRODUCTS - NOT USED.**

**PART 3 EXECUTION**

**3.1 SUBMITTALS SCHEDULE**

- A. After the General Contractor's Construction Schedule has been developed and accepted, prepare a complete schedule of submittals.

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1. Two weeks after notice to proceed, General Contractor shall prepare the Submittals Requirements Schedule in detail:
  - a. Use one line per item for each section and paragraph number
  - b. Provide one copy for the Owner and one copy for the Architect of Record.
  - c. Obtain Architect of Record's and Project Manager's approvals
2. Coordinate the Submittal Schedule with the General Contractor's Construction Schedule, Schedule of Values, Subcontracts, list of products and other pertinent information.
3. Coordinate submittals into logical groupings to facilitate interrelation of several items:
  - a. Finishes which involve Architect of Record selection of colors, textures or patterns.
  - b. Associated items which require correlation for efficient function or for installation.
  - c. Provide:
    - 1) All submittals required by a particular section at one time.
    - 2) Shop drawings, schedules, product data, coordination drawings, samples, color charts and other information as required (whether listed or not) for Architect of Record's complete evaluation.
    - 3) Define the deferred submittal schedule.
  - d. Incomplete information or partial submittals will be cause for rejection.
4. Prepare the schedule in chronological order and provide the following:
  - a. Scheduled date for the initial submittal.
  - b. Section number per this specification.
  - c. Submittal category (Shop Drawing, Product Data or Sample).
  - d. Name of General Contractor.
  - e. Description of the part of the work covered by this submittal.
  - f. Date required for this submittal to be returned but not less than the stipulated date herein.
- B. After approval of the Submittal Schedule, distribute in print and electronically in pdf format to the Owner's representative, Architect, subcontractors and all other parties required to comply with the dates indicated in the Submittal Schedule.
  1. Submit the Submittal Schedule within 10 Working Days of the date required for submittal of the General Contractor's Construction Schedule.
- C. Update and reissue the Submittal Schedule after revised dates, agreed upon by the affected parties, have been approved.

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D. Submittal schedule shall be updated periodically to reflect changes in the construction schedule.

### 3.2 SUBMITTALS FOR REVIEW

A. Submittals shall be numbered according to Architect's Project Manual of Specifications.

B. When the following are specified in individual sections, submit them for review:

1. Product data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - a. Submit only pages which are pertinent. Mark each copy of standard printed data to identify relevant products and the related Specification Section and Article Number.
  - b. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - c. Mark each copy of each submittal to show which products and options are applicable.
2. Include the following information, as applicable:
  - a. Manufacturer's catalog cuts.
  - b. Manufacturer's product specifications.
  - c. Performance characteristics and capacities
  - d. Finishes
    - 1) Standard color charts.
  - e. Component parts
  - f. Statement of compliance with specified referenced standards.
  - g. Testing by recognized testing agency.
  - h. Application of testing agency labels and seals.
  - i. Notation of coordination requirements.
  - j. Other information as required by the individual specification sections
  - k. Availability and delivery time information.
3. For equipment, include the following in addition to the above, as applicable:
  - a. Wiring diagrams showing factory-installed wiring.
  - b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Dimensions

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- e. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  - f. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information that is not applicable.
  - g. Submit Product Data before or concurrent with Samples.
  - h. Submit Product Data in the following format:
    - 1) PDF electronic file.
- C. Shop drawings: Submit newly prepared Project-specific information, drawn accurately to scale.
- 1. Do not reproduce Contract Documents or copy standard product information as the basis of Shop Drawings.
    - a. Submittals received on the Architect's Titleblock will be automatically rejected.
  - 2. Present in a clear and thorough manner Job Specific shop drawings. (Generic shop drawings will be rejected.) Title each drawing sheet with Project Name and Number; identify each element of the drawings by reference to Sheet Number and Detail, Specification Section, Schedule or Room Number listed in the Contract Documents and CAD Standards Manual.
  - 3. Standard information prepared without specific reference to the Project is not a Shop Drawing.
  - 4. Identify field dimensions; show relation to adjacent or critical features of Work or Products.
  - 5. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  - 6. Scale Required: Unless otherwise specifically directed by Architect of Record, make all shop drawings accurate to a scale sufficiently large enough to show all pertinent features of the item and its methods of connection to the Work.
  - 7. Submit Shop Drawings in the following format:
    - a. PDF electronic file.

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8. Provide a 5" x 4" blank space on each submittal sheet or sample label for Architect of Record's review stamp.
- D. Samples for Selection:
1. Provide 4 of each sample or color chart.
  2. Submit full range of manufacturer's standard finishes, except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Architect of Record's selection. ALL color charts shall be originals, no photocopies allowed.
  3. Submit samples to illustrate functional characteristics of products, including parts and attachments.
  4. Label each sample with Project Name and Number, Interior Design Specification Number (as applicable), and Room Number.
- E. Samples for Verification:
1. Provide 4 of each sample or color chart.
  2. Submit full range of manufacturer's standard finishes, except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Architect of Record's selection. ALL color charts shall be originals, no photocopies allowed.
  3. Submit samples to illustrate functional characteristics of products, including parts and attachments.
  4. Label each sample with Project Name and Number, Interior Design Specification Number (as applicable), and Room Number.
- F. Samples will be reviewed only for aesthetic, color, or finish selection.
1. Submit sample of material in size, finish, texture and color as required by the specific specification section and indicating the range of any variations that may occur.
- G. After review, provide copies and distribute in accordance with **Submittal Procedures** article below and for record documents purposes described in Section 01 78 00 - Closeout Procedures and Submittals.
- H. Fire Alarm Shop Drawings shall be submitted to submittal to the Architect whose approval shall be obtained prior to the submittal to the state and local Fire Marshall.

### 3.3 SUBMITTALS FOR INFORMATION:

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
  2. Certificates.
  3. Test reports.

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4. Inspection reports.
  5. Manufacturer's instructions.
  6. Manufacturer's field reports.
  7. Other types indicated.
- B. Submit for Architect's knowledge as Contract Administrator or for Owner. No action will be taken.

### 3.4 SUBMITTALS FOR PROJECT CLOSEOUT:

- A. Submit for Owner's benefit during and after project completion and in accordance with Section 01 7800 - Closeout Procedures and Submittals.
- B. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties & Bonds
  4. Other types as indicated.

### 3.5 NUMBER OF COPIES OF SUBMITTALS

- A. Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Documents for Information: Submit one electronic copy to Architect of Record.
- C. Extra Copies at Project Closeout: See Section 01 7800 - Closeout Procedures and Submittals. Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.
- D. Samples: Submit the number specified in individual specification sections or (4) of each if no specific number is specified in the specific section; one of which will be retained by Architect.
1. After review, produce duplicates.
  2. Retained samples will not be returned to Contractor unless specifically so stated.

### 3.6 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- B. Schedule submittals to expedite the Project and coordinate submission of related items. The General Contractor is solely responsible for coordinating the delivery of submittals, including any necessary corrections and resubmittals, to assure that Architect of Record approval can be obtained without delaying the Work. The General Contractor shall start the submittal process within three weeks after award or as required to meet the Contract Schedule requirements.

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- C. General: Electronic copies of the digital files of the Construction Documents may be made available by the Architect for the General Contractor's use in the preparation of the Submittals. The Architect nor the General Contractor shall be obligated to use such documents in the preparation of the Submittals.
  - 1. Transfer of the digital files from the Architect to the General Contractor shall be subject to the Terms and Conditions of a Digital File Transfer Agreement at the time of such transfer.
  - 2. The use of the digital files prepared by the Architect in the preparation of the Shop Drawings shall not in any way obviate the recipient's responsibility for the proper checking and coordination of dimensions, field conditions, details, member sizes, gauges, quantities, and any other condition as required to facilitate complete and accurate fabrication and erection.
- D. Transmit each submittal with approved form.
- E. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- F. Identify Project Manager, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- G. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- H. General Contractor Review:
  - 1. Review submittals (prior to sending to Architect of Record) to determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
  - 2. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
  - 3. Coordinate submittals with requirements of Work and Contract Documents.
  - 4. Sign or initial each sheet of shop drawings and product data or each sample label to certify compliance with the requirements of Contract Documents using a submittal stamp with the following information incorporated:
    - a. General Contractor Submittal Approval
    - b. By making this Submittal No. \_\_\_\_\_, (Insert General Contractor's Name) does hereby approve said submittal and does certify that it has determined and verified all materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information within this submittal with the requirements of the Work and Contract Documents.
    - c. Signed for the General Contractor: \_\_\_\_\_ Date: \_\_\_\_\_.
- I. Submittal Mark-ups:

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1. Submittals shall be marked-up as follows:
  - a. Contractor Comments: Make all Contractor comments in "Blue" ink.
  - b. Design Team will make all comments in "Red" ink.
- J. Identify Project number, General Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy. Architect will not review submittals that do not bear the General Contractor's approval stamp and will return them without action.
- K. Apply General Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- L. All submittals **NOT** made through the General General Contractor will be rejected.
- M. The Architect will return unsolicited submittals without action.
- N. No portion of the Work which requires a shop drawing or sample submission shall be commenced until the submission has been reviewed and returned as approved by Architect of Record.
- O. Deliver physical submittals to Architect at business address.
- P. For each submittal for the initial review, allow 10 Working Days excluding delivery time to and from the Contractor.
  1. For concurrent review of submittals by Consultants, Owner and other parties, allow 5 additional days excluding time to and from the Contractor.
  2. Extension of review time shall not constitute a basis to automatically extend the Contract time.
- Q. For each resubmittal, allow for 10 Working Days excluding time to and from the General Contractor.
- R. Submittals and Samples shall be submitted in a timely manner to allow for resubmittal and not cause a delay in the Work.
- S. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- T. Provide space of approximately 5" x 4" for Contractor and Architect review stamps.
  1. General Contractor shall include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Project number.
    - d. Name and address of Architect.

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- e. Name and address of General Contractor.
  - f. Name and address of Subcontractor.
  - g. Name and address of Supplier.
  - h. Name of Manufacturer.
  - i. Unique identifier, including revision number(s).
  - j. Number and title of appropriate Specification Section.
  - k. Drawing number and detail references, as appropriate.
  - l. Other necessary identification.
2. Architect shall mark the action stamp indicating the action taken.
- U. When revised for resubmission, identify all changes made since previous submission.
1. The General Contractor shall make any corrections required by the Architect of Record and resubmit.
    - a. The General Contractor shall direct specific attention in writing or on the resubmitted shop drawings to revisions other than the correction(s) required by Architect of Record on previous submissions.
    - b. When revised for resubmission, identify all changes made since previous submission.
    - c. The revised submittal will be identified with the original submittal number plus a suffix to mark it as a resubmittal, i.e. 099900.001-R1, 099900.001a or 099900.001A. If not so identified, the resubmittal will be returned as revise and resubmit with the proper number.
    - d. Should the Contractor's resubmittals be returned as Revise and Re-submit after (3) reviews by the Architect; any further reviews may be processed by the Architect, at the Architect's standard hourly rate. The Architect will charge the Owner, and such costs will be deducted from monies still due the Contractor. The Architect will notify the Owner and Contractor prior to the processing of deficient Submittals.
- V. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.h
- W. Electronic submittals must be provided in a Portable Document Format (.pdf) file when submitted electronically.
1. Prepare file for submittal by converting it to PDF using BlueBeam Revu, latest version. Legible scanned PDF files of plain paper documents are acceptable, but PDF sets created by electronically converting files using BlueBeam Revu are preferable. Scanned documents are more difficult to annotate, are usually less legible, and produce larger attachment sizes.
  2. Ensure that sheets are ready to print out to a PDF format on the appropriate sheet size, with no additional formatting required by the viewer, and with all required information.

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3. Electronic signatures and stamps must be utilized on electronic submittals where signatures and stamps are required in Section 3.1 Submittal Schedule items A.1-4 and Section 3.6 Submittal Procedures items A-W above.
- X. Substitutions will not be considered when they are indicated or implied on shop drawings, product data submittals or samples without a separate written request complying to the requirement in Section 012500 - Short-Circuit Studies.
- Y. Maintain one (1) set of all approved submittals at the Project Site in the General Contractors office.

**END OF SECTION 01 3300**

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**SECTION 01 4000  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 30 00 - Administrative Requirements:
- B. Section 013300 - Aluminum Entrances and Storefront Systems: Deferred Submittals
- C. Section 01 4216 - Definitions.
- D. Section 01 4533 - Code-Required Special Inspections and Procedures
- E. Section 01 60 00 - Product Requirements:

**1.3 REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2023).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2023.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.

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- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

### 1.4 SUBMITTALS

- A. See Section 013300 - Aluminum Entrances and Storefront Systems, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
  - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    - a. Full name.
    - b. Professional licensure information.
    - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
  - 2. Include required product data and shop drawings.
  - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
  - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit (within 24 hours) the listed number of copies:
  - 1. Distribution:
    - a. 1 copy to the Architect.
    - b. 2 copies to the Contractor.
    - c. 1 copy to the Owner's Representative.
  - 2. Include:
    - a. Date issued.

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- b. Project title and number.
  - c. Name of inspector.
  - d. Date and time of sampling or inspection.
  - e. Identification of product and specifications section.
  - f. Location in the Project.
  - g. Type of test/inspection.
  - h. Date of test/inspection.
  - i. Results of test/inspection.
  - j. Compliance with Contract Documents.
  - k. When requested by the Architect, Owner's Representative, or the Contractor; provide interpretation of results.
3. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit report in duplicate within 30 days of observation to Architect for information.
  2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

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2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

### 1.5 QUALITY ASSURANCE

#### A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

#### B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Nevada.

### 1.6 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

### 1.7 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent certified testing agency acceptable to the Architect and Contractor to perform specified testing and inspection as required and specified in the Contract Documents.
- B. Contractor shall employ and pay for services of an independent certified testing agency acceptable to the Architect and Owner to perform specified testing and inspections required to be performed and paid for by the Contractor.

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- C. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- D. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- E. Contractor Employed Agency:
  - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
  - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
  - 3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
  - 4. Laboratory: Authorized to operate in Nevada.
  - 5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  - 6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.1 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### **3.2 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to

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demonstrate the proposed range of aesthetic effects and workmanship.

- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. Make corrections as necessary until Architect's approval is issued.
- H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- J. Where possible salvage and recycle the demolished mock-up materials.

### 3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.4 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required. The following list is only intended to be a guide for the Contractor to aid in determining the testing requirements for the Project. The requirements specified in each specific section shall take precedence over this list and this list is not to be interpreted as being a complete list.
  - 1. 03 3000 - Cast-in-Place Concrete
  - 2. 04 2000 - Unit Masonry

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3. 05 1200 - Structural Steel Framing.
4. 05 3100 - Steel Decking.
5. 05 4000 - Cold-Formed Metal Framing.
6. 07 2400 - Exterior Insulation and Finish Systems.
7. 07 5419 - PVC Thermoplastic Single-Ply Roofing - Carlisle
8. 07 8100 - Applied Fire Protection.
9. 07 8400 - Firestopping
10. 07 9200 - Joint Sealants
11. 08 4313 - Aluminum Entrances and Storefront Systems
12. 08 4413 - Glazed Aluminum Curtain Walls
13. 088000 - Glass and Glazing
14. Division 9 - Flooring Sections regarding moisture content of concrete floors.

### B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

### C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

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### D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  4. Notify laboratory 24 hours minimum, in advance, prior to expected time for operations requiring testing/inspection services.
  5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency.
1. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### 3.5 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Such Manufacturer's personnel shall be accompanied by the Contractor during his time at the site.
- C. Submit qualifications of observer to Architect 30 days in advance of required observations.
  1. Observer subject to approval of Owner.
- D. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.6 DEFECT ASSESSMENT

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- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  - 2. Comply with the Contract Document requirements for Section 01-7329 - Cutting and Patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
- D. Replace Work or portions of the Work not complying with specified requirements.
- E. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION 01 4000**

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**SECTION 01 4100  
REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SUMMARY OF REFERENCE STANDARDS**

- A. Section includes: Regulatory requirements applicable to this project.
- B. Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
- C. Should any conditions develop not covered by the Contract Documents wherein the finished Work will not comply with current codes, a Change Order detailing and specifying the required Work shall be submitted to and approved Architect and Owner before proceeding with the Work.

**1.2 STANDARDS AND CODES**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices 2022.
- D. 29 CFR 1910 - Occupational Safety and Health Standards Current Edition.
- E. ICC (IEBC) - International Existing Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- G. ICC (IFC) - International Fire Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 1 - Fire Code 2024.
- I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. IAPMO (UPC) - Uniform Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. ICC (IMC) - International Mechanical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 4000 - Quality Requirements.

### 1.4 QUALITY ASSURANCE

- A. Contractor shall comply with all codes, laws, ordinances, rules and regulations applicable to the Work, which shall have full force and effect as though printed in full in these Specifications. Code, laws, ordinances, rules and regulations are not furnished to Contractor, because Contractor is assumed to be familiar with these requirements.

### 1.5 PRECEDENCE

- A. Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Drawings and Specifications shall take precedence so long as such increase is legal.
- B. Where no requirements are identified on Drawings or in Specifications, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.
- C. Conflicts between referenced regulatory requirements: Comply with the one establishing the more stringent requirement.
- D. Conflicts between referenced regulatory requirements and Contract Documents: Comply with the one establishing the more stringent requirement.

### 1.6 COMPLIANCE WITH AMERICANS WITH DISABILITIES ACT

- A. Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services, and other activities provided by a public entity to the public, whether directly or through a contractor, must be accessible to the disabled public. Contractor shall provide the services specified in the Contract Documents in a manner that complies with the ADA and any and all other applicable federal, state, and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits, or activities provided under this Agreement and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents, or assigns shall constitute a material breach of the Contract Documents.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

## END OF SECTION 01 4100

### Regulatory Requirements - 01 4100

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**SECTION 01 4216  
DEFINITIONS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions are included in individual specification sections.

**1.2 DEFINITIONS**

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.
- G. Connect: To make the complete necessary utility connection (water, sewer, gas, electricity, etc.) from the building utility to the piece of equipment to allow that piece of equipment to function as intended (e.g., a gas connection for an oven or cooktop).
- H. "Approved equal", "or equal" shall mean as approved and accepted by the Architect and/or Owner.
- I. "As necessary" means essential to the completion of the work.
- J. "As required" means as required by the contract documents.
- K. "As selected", "as approved" or words of similar import mean as selected by, as approved by, or as accepted by the Architect and/or Owner.
- L. "As shown", "as detailed", "as indicated" or words of similar import mean as indicated on the drawings.
- M. "Clear" shall mean to hold to a dimension certain.
- N. "Concealed" means not visible in the finished work.
- O. "Exposed" means visible in the finished work.
- P. "Shall" means mandatory.

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- Q. "Days" means calendar days.
- R. "Working Days" means work days and does not include legal holidays as defined by the Contract.

### 1.3 OWNER FURNISHED - OWNER INSTALLED ITEMS (OFOI)

- A. General: The terms "Furnish," "Install," and "Connect" shall be as defined in Paragraph 1.3 of this Section.
- B. Items furnished and installed by the Owner: Refer to Contract for OFOI items.
- C. Contractor's Responsibilities:
  - 1. Contractor shall give the Owner written notification, stating the date(s) when the Owner Furnished items must be received at the job site to insure Project completion in accordance with the established schedule. Such dates shall be shown on the schedule.
  - 2. Contractor is responsible for the coordination and interface of the Owner-Furnished and Installed Items (OFOI) with the Work of this Contract to provide all necessary mechanical and electrical rough-ins, openings, supports, dimensions, clearances, etc., required for a complete and functional installation.

### 1.4 OWNER FURNISHED - CONTRACTOR INSTALLED ITEMS (OFCI)

- A. General: The terms "Furnish," "Install," and "Connect" shall be as defined in Paragraph 1.3 of this Section.
- B. Items furnished by the Owner and installed by the Contractor: Refer to Contract for OFCI items.
- C. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed Shop Drawings, Product Data, and Samples, to the Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. Upon delivery, inspect products jointly with Contractor.
  - 4. Immediately upon observing the product, submit any claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for Manufacturers' warranties, inspections and service.
- D. Contractor's Responsibilities:
  - 1. Contractor shall provide a written schedule to the Owner, indicating when the Owner-Furnished items must be received at the project site to insure the Project completion in accordance with the established schedule. Such dates shall be shown on the schedule.
  - 2. Review of the Owner-reviewed Shop Drawings, Product data, and Samples.

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3. Receive and unload products at the site. Inspect for completeness or damage jointly with the Owner.
4. Handle, store, assemble, install, protect, connect and finish products including furnishing lubricants and fluids and other procedures necessary to cause products to be operative and serviceable.
5. Contractor shall be responsible for the coordination with the Owner- Furnished items and to provide for all of the necessary mechanical and electrical rough-ins, openings, supports, dimensions, clearances, etc. required for a complete and functional installation.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 4216**

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**SECTION 01 5000  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Fire Protection.
- F. Temporary Barriers, Fencing and Enclosures:
- G. Protection of Installed Work:
- H. Security requirements.
- I. Vehicular access and parking.
- J. Cleaning and Waste removal facilities and services.
- K. Project identification sign.
- L. Field offices.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 5100 - Temporary Utilities.

**1.3 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

**1.4 DEWATERING**

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities in operable condition.

**1.5 GENERAL**

- A. Comply with codes and regulations regarding potable drinking water, sanitation, dust control, fire protection, and other temporary controls.

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- B. Interruptions of the utility service to the existing property is not permitted. However, in the event such interruption is needed, obtain written approval from the Owner's Representative a minimum of 72 hours prior to disconnection or shutting off any service or utility. Contractor shall notify Owner of any planned interruption of utilities and services in writing.
- C. Remove all temporary facilities and construction from the site as soon as practical and possible and in the opinion of the Owner's Representative the progress of the work deems it practical.
- D. Restore and refurbish the areas of the site occupied by the temporary facilities to a form acceptable to the Architect and the Owner's Representative.

### 1.6 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

### 1.7 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.
  - 2. WIFI connection: High speed/ broad band internet service shall be provided.

### 1.8 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.
- C. At end of construction, return facilities to same or better condition as originally found.

### 1.9 TEMPORARY FIRE PROTECTION

- A. Provide the required quantity of fire extinguishers, UL labeled ABC all-purpose for protection of the Work.
- B. Provide temporary field office, storage and sheds with required fire extinguishers.
- C. Comply with fire insurance and governing agencies.

### 1.10 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

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- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and a temporary exit and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

### 1.11 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.
- C. Gates in the fencing are to be located to provide access to work areas. Provide locks for each gate.
- D. Close and lock access to work after working hours.

### 1.12 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

### 1.13 PROTECTION OF INSTALLED WORK

- A. Protect all installed work.
- B. Provide temporary and removable barriers for installed work.
- C. Provide special protection as required by specification sections and in accordance with manufacturer's written instructions.
- D. Provide protective covering at all openings.
- E. Provide protection of finished floors and other surfaces subject to traffic and movement of heavy objects with plywood sheeting and waterproof cover.
- F. Prohibit traffic or storage on any waterproofed or roofed surface. If traffic or storage is required for any reason, provide for protection of the surface in accordance with the manufacturer's written instructions.
- G. Prohibit traffic or storage in any new or existing landscaped area.

### 1.14 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

### 1.15 VEHICULAR ACCESS AND PARKING

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- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Restrict site access and parking to areas designated by the Owner.
- E. Provide means of removing mud from vehicle wheels before entering streets.
- F. Owner designated on-site roads may be used for construction traffic.
- G. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- H. Existing parking areas may be used for construction parking.
- I. Provide one parking space for Owner use.
- J. Provide one parking space for Architect use.

### 1.16 CLEANING AND WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition. Do not allow to accumulate.
- B. Provide containers with lids. Remove trash from site daily.
- C. Remove all debris from enclosed spaces such as plenums, chases, pipe chases, and all other enclosed spaces prior to enclosing the space.
- D. At a minimum, broom clean and vacuum interior areas prior to the start of installing surface finishes. Thereafter, continue cleaning to eliminate dust and any other deleterious matter.
- E. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- F. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

### 1.17 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

### 1.18 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

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- B. Provide space for Project meetings, with table and chairs to accommodate 24 persons.
- C. Locate offices and sheds in locations as approved by the Owner.

**1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 5000**

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**SECTION 01 6000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this section.

**1.2 SECTION INCLUDES**

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary:
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 017300 - Execution Requirements.
- D. Section 01 4000 - Quality Requirements.
- E. Section 01 4216 - Definitions.

**1.4 REFERENCE STANDARDS**

- A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content Current Edition.
- B. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.
- C. NEMA MG 1 - Motors and Generators 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.5 DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system,"

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and terms of similar intent.

1. **Named Products:** Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  2. **New Products:** Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  3. **Comparable Product:** Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. **Basis-of-Design Product Specification:** A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

### 1.6 SUBMITTALS

- A. Refer to Section 01 3300 - Submittal Requirements, for additional submittal requirements.
- B. **Proposed Products List:** Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
  1. Submit within 15 days after date of Agreement.
  2. For products specified only by reference standards, list applicable reference standards.
- C. **Product Data Submittals:** Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. **Shop Drawing Submittals:** Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. **Sample Submittals:** Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- F. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

### 1.7 QUALITY ASSURANCE

- A. **Compatibility of Options:** If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

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1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Reused Products: Materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
1. Wood fabricated from timber abandoned in transit after harvesting is considered reused, not recycled.
  2. Acceptable Evidence: Information about the origin or source, from Contractor or supplier.

### 1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
  2. Store materials in a manner that will not endanger Project structure.
  3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  6. Protect stored products from damage and liquids from freezing



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7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

### 1.9 PRODUCT WARRANTIES

- A. Submittal Time: Comply with requirements in Section 01 7800 - Closeout Procedures and Submittals.
- B. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents. Refer to Section 01 7836 - Warranties and Bonds.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a
  2. particular product and specifically endorsed by manufacturer to Owner.
  3. Special Warranty: Written warranty required by the Contract Documents to provide
  4. specific rights for Owner.
- C. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

## PART 2 PRODUCTS

### 2.1 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.
- E. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.

### Product Requirements - 01 6000

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1. See drawings for list of items required to be salvaged for reuse and relocation.
2. If reuse of other existing materials or equipment is desired, submit substitution request.

### 2.2 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  1. Made using or containing CFC's or HCFC's.
  2. Made of wood from newly cut old growth timber.
  3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
  1. If used on interior, have lower emissions, as defined in Section 01 6116.
  2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
  3. Are extracted, harvested, and/or manufactured closer to the location of the project.
  4. Have longer documented life span under normal use.
  5. Result in less construction waste. See Section 01 7419
  6. Are made of vegetable materials that are rapidly renewable.
  7. Are made of recycled materials.
  8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
  9. If bio-based, other than wood, are or are made of Sustainable Agriculture Network certified products.
- D. Provide interchangeable components by the same manufacture for components being replaced.
- E. Motors: Refer to Electrical Drawings, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.
- F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- G. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

### 2.3 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

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1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":
1. Select the specified Product or a Product by a named manufacturer having equivalent or superior characteristics to the specified Product and meeting the requirements of the Contract Documents.
  2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
  3. The specified Product establishes the required standard of quality.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Article 3.1 of this Specification.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Products specified by naming one Product followed by the statement "Substitutions: Not permitted": Substitutions will not be allowed.
- F. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
1. Select any Product meeting the specified standard.
  2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

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- G. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- H. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- I. Products specified by required performance or attributes, without naming a manufacturer or Product:
  - 1. Select any Product meeting specified requirements.
  - 2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

### 2.4 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site and by the Contractor; obtain receipt prior to final payment.

## PART 3 EXECUTION

### 3.1 SUBSTITUTION PROCEDURES - REFER TO SECTION 01 2500 - SUBSTITUTION PROCEDURES.

### 3.2 OWNER-FURNISHED PRODUCTS

- A. Refer to Section 01 4216 - Definitions for specific requirements for:
  - 1. OWNER FURNISHED - OWNER INSTALLED (OFOI) products.
  - 2. OWNER FURNISHED - CONTRACTOR INSTALLED (OFCI) products.
- B. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
  - 1. Contractor shall provide a written schedule to the Owner indicating when the Owner Furnished items must be received at the project site to insure the Project completion in accordance with the established schedule. Such dates shall be shown on the schedule.
  - 2. Review Owner reviewed shop drawings, product data, and samples.
  - 3. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

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4. Handle, store, install and finish products.
5. Repair or replace items damaged after receipt.

### 3.3 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### 3.4 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels visible, intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

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- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION 01 6000**

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**SECTION 01 7300  
EXECUTION REQUIREMENTS**

**PART 1 -GENERAL**

**1.1 SUMMARY**

- A. Section includes: General procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of Products.
  - 4. Progress cleaning.
  - 5. Starting and adjusting.
  - 6. Protection of installed construction.
  - 7. Correction of the Work.
  - 8. Adjustment of the Work
  - 9. Final Cleaning
  - 10. General requirements for maintenance service.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 10 00 - Summary:
- B. Section 01 30 00 - Administrative Requirements: For Coordination Drawing requirements.
- C. Section 01 40 00 - Quality Requirements:
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 01 73 29 - Cutting and Patching:
- F. Section 01 78 00 - Closeout Procedures and Submittals:
- G. Section 01 78 36 - Warranties and Bonds:
- H. Section 02 41 00 - Selective Demolition:
- I. Individual Product Specification Sections:
  - 1. Advance notification to other sections of openings required in work of those sections.
  - 2. Limitations on cutting structural members.

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### 1.3 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

### 1.4 SUBMITTALS

- A. See Section 013300 - Aluminum Entrances and Storefront Systems, for submittal procedures.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

### 1.5 QUALIFICATIONS

- A. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Nevada.

### 1.6 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
  - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
  - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
  - 2. Outdoors: Limit conduct of noisy exterior work to hours approved by the Owner's Representative.
  - 3. Indoors: Limit conduct of noisy interior work to hours approved by the Owner's Representative.

### 1.7 COORDINATION

- A. Verify all dimensions and conditions at the site.
- B. Coordinate the Work of this section with all trades.
- C. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions

## Execution Requirements - 01 7300

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for accommodating items installed later.

- D. Notify affected utility companies and comply with their requirements.
- E. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- F. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- G. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- H. Coordinate completion and clean-up of work of separate sections.
- I. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- J. All work, including materials and workmanship, shall conform to the requirements of applicable local codes, laws, ordinances, the adopted building codes, ANSI A117.1 - Guidelines for Accessible & Useable Buildings and Facilities, and ADAAG- ADA Accessibility Guidelines for Buildings & Facilities.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the maximum allowable VOC levels.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
- B. Before construction, verify the location and points of connection of utility services.
- C. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

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1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- D. Acceptance of Conditions:
1. Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations. Start of work means acceptance of existing conditions.
  2. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- E. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- F. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- G. Examine and verify specific conditions described in individual specification sections.
- H. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.
- I. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
- J. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
- K. Notify Owner and Architect of discrepancies prior to commencement of Work.

### **3.2 PREINSTALLATION CONFERENCES - REFER TO SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS.**

### **3.3 PREPARATION**

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a

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detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
  - 7. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
  - 8. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
  - 9. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

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### 3.6 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level, unless otherwise indicated.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
  - 4. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
- G. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- H. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- I. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

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1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
4. Site: Maintain Project site free of waste materials and debris.
5. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - a. Remove liquid spills promptly.
  - b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
6. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
7. Concealed Spaces: Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
8. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
9. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
10. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
11. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
12. Collect and remove waste materials, debris, and trash/rubbish from site daily and dispose off-site; do not burn or bury.

### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

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- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 29 - Cutting and Patching.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
  - 2. Restore permanent facilities used during construction to their specified condition.
  - 3. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
  - 4. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
  - 5. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

### 3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

### 3.11 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

### 3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: Refer to Drawings.

### 3.13 FINAL CLEANING

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- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Execute final cleaning prior to Substantial Completion.
  - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- C. Use cleaning materials that are nonhazardous.
- D. Clean interior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- E. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- F. Remove tools, construction equipment, machinery, and surplus material from Project site.
- G. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances.
  - 1. Avoid disturbing natural weathering of exterior surfaces.
  - 2. Restore reflective surfaces to their original condition.
- H. Remove debris and surface dust from limited access spaces, including plenums, shafts, equipment vaults, and similar spaces.
- I. Sweep concrete floors broom clean in unoccupied spaces.
- J. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- K. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- L. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- M. Replace filters of operating equipment. Clean exposed surfaces of diffusers, registers, and grills.
- N. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - 1. Clean HVAC system in compliance with NADCA Standard; 2021. Provide written report on completion of cleaning.
- O. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- P. Clean debris from roofs, gutters, downspouts, and drainage systems.

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- Q. Clean site; sweep paved areas, rake clean landscaped surfaces.
- R. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- S. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- T. Clean Owner-occupied areas of work.
- U. Provide Project Manager with clean material's MSDS sheets.

### 3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION 01 7300**



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**SECTION 01 7800  
CLOSEOUT PROCEDURES AND SUBMITTALS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Administrative and procedural requirements for contract closeout including, but not limited to the following: (as part of Set of Manuals & Documents for Commissioning process) Inspection procedures including Pre-Functional Checklists and Pre-Substantial Checklists.
- B. Functional Testing Procedures (part of Commissioning process)
- C. Project record documents.
- D. Operation and maintenance data.
- E. Substantial Completion procedures.
- F. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 1 through 48 and shall be coordinated with this Section

**1.2 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements.
- B. Section 017300 - Execution Requirements: Contract closeout procedures.
- C. Section 01 7836 - Warranties and Bonds.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

**1.3 SUBMITTALS**

- A. See Section 013300 - Aluminum Entrances and Storefront Systems, for submittal procedures.
- B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
  - 1. Provide duplicate, notarized copies of the documents required in the Final Completion and Final Payment article of the General Conditions.
- C. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.

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3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
4. Submit two sets of revised final documents in final form within 10 days after final inspection.

### 1.4 SUBSTANTIAL COMPLETION

- A. Definition: Substantial Completion is that condition which occurs when the Owner accepts the certification of the Architect that construction is sufficiently complete in accordance with the Contract Documents so that the Project may be occupied for the use for which it is intended.
- B. Contractor Notification: When Contractor considers work substantially complete, and after the building commissioning and training, submit written declaration to the Architect that Work or designated portion thereof, is substantially complete. Include list of items to be completed or corrected.
- C. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
  1. Prepare a list of items to be completed and corrected (Contractor's punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Advise Owner of pending insurance changeover requirements.
  3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar re-leases.
  5. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  6. Prepare and submit: Completed Commissioning Manual including but not limited to - Summary by specification # Record of Approved Submittals and Samples, Project Record Documents (including but not limited to As-Built Record Drawings, As-Built Record Specifications, Operating and Maintenance Manuals, Certification of No Asbestos Products Incorporated in Project, Completed Punch Lists, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems.
  9. Submit test/adjust/balance records and Specification compliant Final Report.
  10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

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11. Advise Owner of changeover in heat and other utilities.
  12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  13. Complete final cleaning requirements, including touchup painting.
  14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
  15. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  16. Prior to preliminary Substantial Completion and Inspection - Submit:
    - a. Operating and Maintenance Data
    - b. Keys and keying schedule
    - c. Guarantees, Warranties and Bonds
    - d. Completed pre-substantial completion checklists
- D. Preliminary Inspection: Architect will make a preliminary inspection within 7 business days after receipt of Contractor's declaration.
- E. Submit a written request for inspection for Substantial Completion. Upon receipt of request, Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion A.I.A. Document G704 or similar, after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.
- F. Upon determining that Work is substantially complete, Architect will:
1. Punch List: Prepare a punch list of items to be completed or corrected, as determined by the inspection.
  2. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
    - a. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
    - b. Include the following information at the top of each page:
      - 1) Project name.
      - 2) Date.

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- 3) Name of Architect and Construction Manager.
  - 4) Name of Contractor.
  - 5) Page number.
- c. Submit list of incomplete items in the following format:
- 1) PDF electronic file.
3. Certificate: Prepare and process a certificate of substantial completion, containing:
- a. Date of substantial completion.
  - b. Punchlist of items to be completed or corrected.
  - c. The time within which punchlist items shall be completed or corrected.
  - d. Date and time the Owner will take occupancy of Project or designated portion thereof.
  - e. Responsibilities of Owner and Contractor for:
    - 1) Insurance.
    - 2) Utilities.
    - 3) Operation and maintenance of mechanical, electrical and other systems.
    - 4) Maintenance and cleaning.
    - 5) Security.
  - f. Signatures of:
    - 1) Architect.
    - 2) General Contractor.
    - 3) Owner.
    - 4) Prime Contractor.
- G. Contractor is responsible for the following:
1. Corrections: Complete all Work listed for completion or correction within designated time.
  2. Final Cleaning: Perform final cleaning.
- H. Occupancy: Using Agency will occupy Project or designated portions thereof under provisions stated in the Certificate of Substantial Completion.
- I. Complete All Work: At time of inspection, should substantial completion not be certified, Contractor shall complete the Work and resubmit declaration in accordance with the requirements of this Section.

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### 1.5 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and complete operations where required.
  2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
  4. Submit consent of surety to final payment.
  5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  6. Submit pest-control final inspection report and warranty.
  7. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Final Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection with Contractor or/and as appropriate notify Contractor of unfulfilled requirements to ensure completion of all Contract requirements.
- C. Closeout Documents: Architect will prepare and process closeout documents when all Work is considered finally complete in accord with Contract Document requirements including all Deliverable Documentation.
- D. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
- E. Re-inspection Procedure:
1. The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
  2. Upon successful completion of re-inspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. When necessary, reinspection will be repeated.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

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### 3.1 CLOSEOUT PROCEDURES

- A. Accompany Project Manager on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
- B. Accompany Project Manager on preliminary final inspection.

### 3.2 CLOSEOUT SUBMITTALS

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to Architect and Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Substantial Completion.
- D. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- E. Owner will occupy all of the building as specified in Section 01 10 00.
- F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- G. Accompany Project Coordinator on preliminary final inspection.
- H. Notify Architect when work is considered finally complete.
- I. Complete items of work determined by Architect's final inspection.

### 3.3 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
  - 7. Inspection Reports.
  - 8. Field Test Reports and Records.
  - 9. Factory Test Reports and Records.

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- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Maintain for record purposes at a location approved by the Architect /Owner, electronic files for those shop drawings and other documents which are required to be submitted electronically. Ensure that backups of electronic files are made on a regular basis and stored at a remote location.
- D. Store record documents separate from documents used for construction.
- E. Record information concurrent with construction progress.
- F. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and modifications.
- G. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish first floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.
- H. Final Punchlist.
- I. Receipt from AHJ regarding substantial completion and certificate of occupancy.

### 3.4 OPERATION AND MAINTENANCE DATA

- A. Owner's Manual: Prior to final payment, provide three copies (two printed and one digital) hardback, loose-leaf binders, and a "pdf" format file of same, containing the following required submittals and any others required in other Sections, suitably typed, indexed and labeled for ready reference, to the Owner with notification to the Architect of each transmittal and an affidavit that the Manual is complete and in accordance with the Project Specifications.
- B. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
  - 1. Warranties and certifications.

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2. Affidavit from General Contractor and subcontractors on use of asbestos free materials.
  3. Maintenance and operating instructions and parts list.
  4. List of extra materials delivered to Owner, signed by Owner's representative.
  5. Other items required by the Specifications.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.5 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
  2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

### 3.6 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
  2. Identify function, normal operating characteristics, and limiting conditions.
  3. Include performance curves, with engineering data and tests.
  4. Complete nomenclature and model number of replaceable parts.



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- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

### 3.7 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Submit two draft copies of the Operation and Maintenance Manuals a minimum of 14 days prior to requesting the inspection for Substantial Completion or the scheduled date for Substantial Completion, whichever is earliest.

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- D. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- E. Prepare data in the form of an instructional manual.
- F. Prior to the final payment, submit to the Owner, one binder with the required information identified in this section.
- G. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- H. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- I. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- J. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- K. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- L. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- M. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- N. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- O. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.

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- e. Maintenance instructions for equipment and systems.
  - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
3. Part 3: Project documents and certificates, including the following:
- a. Shop drawings and product data.
  - b. Air and water balance reports.
  - c. Certificates.
  - d. Photocopies of warranties and bonds.
- P. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- Q. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

### 3.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Deliver spare parts, extra stock, tools and other items specified in individual specification sections to the Owner with a copy of the transmittal to the Architect. Label with manufacturer's name and model number where applicable. Obtain a signed and dated receipt from the Owner of this transfer.

**END OF SECTION 01 7800**

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**SECTION 01 7836  
WARRANTIES AND BONDS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES:**

- A. Warranties and bonds:

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
  - 1. Refer to the General Conditions and Standard Construction Management Agreement for additional terms and requirements affecting the Work.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Manufacturer's warranties will begin upon Final Acceptance by Owner. Equipment was used, started or operated during construction period. "Acceptance" will be mutually agreed by Owner, Architect, Engineer and Owners Representative.

**1.3 RELATED SECTIONS**

- A. Section 013000 - Administrative Requirements: Shop drawings, product data, and samples.
- B. Section 013300 - Aluminum Entrances and Storefront Systems: Submittals procedures.
- C. Section 01 7800 - Closeout Procedures and Submittals: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

**1.4 DEFINITIONS**

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

**1.5 WARRANTY REQUIREMENTS**

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

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- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

### 1.6 SUBMITTALS

- A. See Section 013300 - Aluminum Entrances and Storefront Systems, for submittal procedures.
- B. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
  - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
- C. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
- D. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance, to Project Manager.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment, to Project Manager.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period, to Project Manager.

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- E. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- F. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8- 1/2-by-11-inch paper.
  - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
  - 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name, address and telephone number of the Contractor and equipment supplier; and name of responsible company principal.
  - 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION**

#### **3.1 LIST OF WARRANTIES**

- A. Schedule: Provide warranties on products and installations as specified in individual Sections in Divisions 2 through 28.

#### **3.2 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submission.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

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- G. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**END OF SECTION 01 7836**

**Warranties and Bonds - 01 7836**

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**SECTION 01 7900  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Landscape irrigation.
  - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
  - 2. Finishes, including flooring, wall finishes, ceiling finishes.
  - 3. Fixtures and fittings.
  - 4. Items specified in individual product Sections.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Procedures and Submittals: Operation and maintenance manuals.
- B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.
- C. Other Specification Sections: Additional requirements for demonstration and training.

**1.3 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures; except:
  - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
  - 2. Submit one copy to the Commissioning Authority, not to be returned.
  - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.

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4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
1. Submit to Commissioning Authority for review and inclusion in overall training plan.
  2. Submit not less than four weeks prior to start of training.
  3. Revise and resubmit until acceptable.
  4. Provide an overall schedule showing all training sessions.
  5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
  2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  3. Provide one extra copy of each training manual to be included with operation and maintenance data.

### 1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

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2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.1 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.

#### **3.2 TRAINING - GENERAL**

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

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- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
  2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  6. Discuss common troubleshooting problems and solutions.
  7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION 01 7900**

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**SECTION 01 9113  
GENERAL COMMISSIONING REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
  - 1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
  - 2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
  - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
  - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.
- C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
- D. The Commissioning Authority is employed by Owner.

**1.2 SCOPE OF COMMISSIONING**

- A. The following are to be commissioned:
- B. Building envelope:
  - 1. Thermal and moisture integrity.
  - 2. Air tightness.
- C. Structural systems.
- D. Fire Protection Systems.
- E. Plumbing Systems:
- F. HVAC System, including:
  - 1. Major and minor equipment items.

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2. Piping systems and equipment.
  3. Ductwork and accessories.
  4. Terminal units.
  5. Control system.
  6. Vibration control devices.
  7. Variable frequency drives.
- G. Electrical Systems:
1. Power quality.
  2. Emergency power systems.
  3. Uninterruptible power systems.
  4. Lighting controls other than manual switches.
- H. Electronic Safety and Security:
1. Security system, including doors and hardware.
  2. Fire and smoke alarms.
- I. Communications:
1. Voice and data systems.
- J. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- K. Sound Transmission Class-rated interior partitions.

### 1.3 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Procedures and Submittals: Scope and procedures for operation and maintenance manuals and project record documents.
- B. Section 23 0800 - Commissioning of HVAC: HVAC control system testing; other requirements.

### 1.4 REFERENCE STANDARDS

- A. ANSI/RESNET/ICC 301 - Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units Using an Energy Rating Index 2019.
- B. ANSI/RESNET/ICC 380 - Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems 2019.

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- C. ASHRAE Std 202 - Commissioning Process for Buildings and Systems 2018, with Addendum (2023).
- D. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings 2023.
- E. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization 2019.
- F. CSI/CSC MF - Masterformat 2016.
- G. NEBB S110 - Whole Building Technical Commissioning of New Construction 2019.
- H. PECEI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests Current Edition.

### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures; except:
  - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
  - 2. Submit one copy to the Commissioning Authority, not to be returned.
  - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
  - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
  - 5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
- B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
  - 1. Manufacturer's product data, cut sheets, and shop drawings.
  - 2. Manufacturer's installation instructions.
  - 3. Startup, operating, and troubleshooting procedures.
  - 4. Fan and pump curves.
  - 5. Factory test reports.
  - 6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.
- C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- D. Startup Plans and Reports.

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- E. Completed Prefunctional Checklists.
- F. Commissioning Issues Log:
  - 1. Construction observations.
  - 2. Supporting photographs.
- G. Field-test report of partitions for noise isolation.

### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## PART 2 PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Provide all standard testing equipment required to perform building envelope air tightness testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- C. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
  - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
  - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
  - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- D. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.
- E. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
  - 1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

## PART 3 EXECUTION

### General Commissioning Requirements - 01 9113

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### 3.1 COMMISSIONING PLAN

- A. Commissioning Authority has prepared the Commissioning Plan.
  - 1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
  - 2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- D. Commissioning Schedule:
  - 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
  - 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
  - 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
  - 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

### 3.2 DOCUMENTATION IDENTIFICATION SYSTEM

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
  - 1. Startup Plan: SP-.
  - 2. Startup Report: SR-.
  - 3. Prefunctional Checklist: PC-.
  - 4. Functional Test Procedure: FTP-.
  - 5. Functional Test Report: FTR-.
- C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
  - 1. 2300: HVAC system as a whole.
  - 2. 2320: HVAC Piping and Pumps.
  - 3. 2330: HVAC Air Distribution.



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- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.
- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

### 3.3 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

### 3.4 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
  - 1. No sampling of identical or near-identical items is allowed.
  - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
  - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
    - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
    - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
    - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
    - d. Serial number of installed unit.
    - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
    - f. Sensor and actuator calibration information.
  - 4. PECEI (Samples) found at <http://www.peci.org/library/mcpgs.htm> indicate anticipated level of detail for Prefunctional Checklists.

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- B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
  - 1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
  - 2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
  - 3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
  - 4. If any Checklist line item is not relevant, record reasons on the form.
  - 5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
  - 6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
  - 7. Submit completed Checklists to Commissioning Authority within two days of completion.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
  - 1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
  - 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
  - 3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
  - 4. When asked to review the proposed Checklists, do so in a timely manner.
- D. Commissioning Authority Witnessing: Required for:
  - 1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
  - 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
  - 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

### 3.5 FUNCTIONAL TESTS

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- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
  - 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
  - 2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
  - 3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
  - 4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
  - 5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
  - 1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
  - 2. Examples of Functional Testing:
    - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
    - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

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- c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
  - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
3. PECEI (Samples) found at <http://www.peci.org/library/mcpgs.htm> indicated anticipated level of detail for Functional Tests.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

### 3.6 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
  - 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
  - 2. Verify that sensors with shielded cable are grounded only at one end.
  - 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
  - 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters - Standard Application:
  - 1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
  - 2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
  - 3. If not, install offset, calibrate or replace sensor.
- E. Sensors With Transmitters - Standard Application.
  - 1. Disconnect sensor.
  - 2. Connect a signal generator in place of sensor.

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3. Connect ammeter in series between transmitter and building automation system control panel.
  4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
  5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
  6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
  7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
  8. Reconnect sensor.
  9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
  10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
  11. If not, replace sensor and repeat.
  12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
  2. Pressure, Air, Water, Gas: 3 percent of design.
  3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
  4. Relative Humidity: 4 percent of design.
  5. Barometric Pressure: 0.1 inch of Hg.
  6. Flow Rate, Air: 10 percent of design.
  7. Flow Rate, Water: 4 percent of design.
  8. AHU Wet Bulb and Dew Point: 2.0 degrees F.
  9. Oxygen and CO2 Monitors: 0.1 percentage points.
  10. CO Monitor: 0.01 percentage points.
  11. Natural Gas and Oil Flow Rate: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:

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1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
  2. Set pump/fan to normal operating mode.
  3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
  4. Command valve/damper to open; verify position is full open and adjust output signal as required.
  5. Command valve/damper to a few intermediate positions.
  6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
  2. Use an ultra-sonic flow meter to detect flow or leakage.

### 3.7 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
  2. Sampling is not allowed for:
    - a. Major equipment.
    - b. Life-safety-critical equipment.
    - c. Prefunctional Checklist execution.
  3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
  4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.

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5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
  6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
  7. If YY percent of the units in the second sample fail, test all remaining identical units.
  8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
  2. Other points will be monitored by the Commissioning Authority using dataloggers.
  3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
  4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
  5. Graphical output is desirable and is required for all output if the system can produce it.
  6. Monitoring may be used to augment manual testing.

### 3.8 BUILDING ENVELOPE COMMISSIONING

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- A. General: Comply with the following procedural requirements:
  - 1. NEBB S110 Whole Building Technical Commissioning of New Construction.
- B. Verify that the building envelope has been sufficiently completed for testing to commence.
- C. Conduct ongoing inspections as construction progresses to document satisfactory installation conditions. related to thermal and moisture integrity of the building envelope that become concealed upon completion of construction.
- D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
  - 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

### 3.9 FIELD TESTING AND COMMISSIONING OF PARTITIONS FOR NOISE ISOLATION

- A. Conduct testing of partitions requiring a specific STC class indicated on drawings and/or in various specifications sections. Comply with ASTM E336 for testing methods, including requirements of Annex A1 for reduction of flanking sound transmission.
- B. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
  - 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

### 3.10 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 7800 - Closeout Procedures and Submittals for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

**END OF SECTION 01 9113**



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**SECTION 03 3000  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Concrete formwork.
- B. Concrete for composite floor construction.
- C. Floors and slabs on grade.
- D. Concrete foundation walls.
- E. Underslab Vapor Retarder.
- F. Concrete reinforcement.
- G. Joint devices associated with concrete work.
- H. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, and flagpole bases.
- I. Concrete curing.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
- B. Section 07 2100 - Building Insulation: Underslab and perimeter insulation.
- C. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

**1.3 REFERENCE STANDARDS**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide 2022.
- C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete 1998 (Reapproved 2004).
- D. ACI 301 - Specifications for Concrete Construction 2020.
- E. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.
- F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- G. ACI 305R - Guide to Hot Weather Concreting 2020.

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- H. ACI 306R - Guide to Cold Weather Concreting 2016.
- I. ACI 308R - Guide to External Curing of Concrete 2016.
- J. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).
- K. ACI 347R - Guide to Formwork for Concrete 2014 (Reapproved 2021).
- L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- M. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2019.
- N. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- O. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field 2023.
- P. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2023.
- Q. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2023.
- R. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2023.
- S. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.
- T. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- U. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- V. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2020.
- W. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete 2017.
- X. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2023.
- Y. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- Z. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
- AA. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2023.
- BB. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).

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- CC. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes 2023.
- DD. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2023, with Editorial Revision.
- EE. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2017.
- FF. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2023.
- GG. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement 2018.
- HH. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
- II. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2021.
- JJ. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- KK. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.
- LL. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2019.
- MM. ASTM C1582/C1582M - Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete 2011, with Editorial Revision (2017).
- NN. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2023.
- OO. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types) 2023.
- PP. ASTM D2103 - Standard Specification for Polyethylene Film 2023a.
- QQ. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.
- RR. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric) 2014.
- SS. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- TT. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017 (Reapproved 2023).
- UU. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete 1992.

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VV. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops 1974.

WW. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop 1974.

XX. ICC-ES AC308 - Acceptance Criteria for Termite Physical Barrier Systems 2021, with Editorial Revision (2022).

YY. ICC (IBC) - 2018 - International Building Code 2018.

1. With Northern Nevada Amendments

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
  1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design.
  1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Test Reports: Submit termite-resistant sheet manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.
- G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.5 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

## PART 2 PRODUCTS

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### 2.1 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
  - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
  - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
  - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
  - 4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

### 2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi). Reinforcing to be welded shall conform to ASTM A706/A706M, Grade 60 (60,000 psi).
  - 1. Type: Deformed billet-steel bars.
  - 2. Finish: Unfinished, unless otherwise indicated.
  - 3. Finish: Galvanized in accordance with ASTM A767/A767M, Class I, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
  - 1. Form: Flat Sheets.
  - 2. WWR Style: 6 x 6-W1.4 x W1.4.
- C. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
  - 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

### 2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type II - Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
  - 1. Acquire aggregates for entire project from same source.

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- C. Lightweight Aggregate: ASTM C330/C330M.
- D. Fly Ash: ASTM C618, Class C or F.
- E. Calcined Pozzolan: ASTM C618, Class N.
- F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

### 2.4 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
  - 1. Manufacturers:
    - a. W. R. Meadows, Inc; Hydraset: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- H. Retarding Admixture: ASTM C494/C494M Type B.
- I. Water Reducing Admixture: ASTM C494/C494M Type A.
  - 1. Manufacturers:
    - a. Euclid Chemical Company; EUCON NW: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
- J. Shrinkage Reducing Admixture:
  - 1. ASTM C494/C494M, Type S.
  - 2. Manufacturers:
    - a. Euclid Chemical Company; Eucon SRA Floor: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. Euclid Chemical Company; Eucon SRA-XT: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. GCP Applied Technologies; Eclipse 4500: [www.gcpat.com/#sle](http://www.gcpat.com/#sle).
- K. Corrosion Inhibiting Admixture:
  - 1. ASTM C494/C494M, Type C.
  - 2. ASTM C1582/C1582M.

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- L. Microbiologically-Induced Corrosion Inhibiting Admixture: Resists growth of bacteria and fungi on or inside concrete.
  - 1. Manufacturers:
    - a. ConShield Technologies, Inc; ConShield HD: [www.conshield.com/#sle](http://www.conshield.com/#sle).
- M. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
  - 1. Provide admixture in slabs to receive adhesively applied flooring.
- N. Integral Hardening Admixture: Dry powder added to concrete during batching.

### 2.5 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
  - 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
  - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
  - 3. Manufacturers:
    - a. Basis of Design :Stego Industries, LLC; Stego Wrap Vapor Barrier 10-mil (Class A):: [www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
    - b. Poly-America; Husky Yellow Guard 10-mil Vapor Barrier: [www.yellowguard.com/#sle](http://www.yellowguard.com/#sle).
    - c. ISI Building Products; Viper VaporCheck II 15-mil (Class A): [www.isibp.com/#sle](http://www.isibp.com/#sle).
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
  - 1. Grout: Comply with ASTM C1107/C1107M.
  - 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
    - a. Maximum: Plus 0.06 percent.
    - b. Minimum: Plus 0.02 percent.
  - 3. Minimum Compressive Strength at 24 Hours, ASTM C109/C109M: 4,500 pounds per square inch.
  - 4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa) above fluid consistency.
  - 5. Low-Slump, Dry Pack Products:

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- C. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
  - 1. Composition: High solids content material exhibiting positive expansion when tested in accordance with ASTM C827/C827M.
    - a. Maximum Height Change: 0.06 percent.
    - b. Minimum Height Change: 0.02 percent.
  - 2. Minimum Compressive Strength at 7 days, ASTM C579: 11,000 pounds per square inch.
  - 3. Minimum Compressive Strength at 7 days, ASTM D695: 11,000 pounds per square inch (82.7 MPa).
  - 4. Manufacturers:
    - a. Sika.
    - b. Euclid.
    - c. Or Equal.

### 2.6 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
  - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Waterstops: Rubber, complying with COE CRD-C 513.
  - 1. Configuration: As indicated on drawings.
  - 2. Size: As indicated on drawings.
- D. Waterstops: PVC, complying with COE CRD-C 572.
  - 1. Configuration: As indicated on drawings.
  - 2. Size: As indicated on drawings.
- E. Waterstops: Synthetic rubber; swells to 1000 percent of original size in clean water.
  - 1. Configuration: As indicated on drawings.
  - 2. Size: As indicated on drawings.
- F. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.



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1. Size: As indicated on drawings.
  2. Size: 1/2 inch (13 mm) throat, 1/2 inch (13 mm) deep.
- G. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
1. Material: ASTM D1751, cellulose fiber.
- H. Slab Control Joint Devices: Saw joints and doweled joints per structural drawings.
- I. Slab Construction Joint Devices: Diamond dowel plates per structural drawings.

### 2.7 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
1. Application: Use at all concrete slabs.
  2. Product dissipates within 4 to 6 weeks.
  3. VOC Content: Zero.
  4. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.
  5. Products: VC-5 by Sinak Corporation or an approved equal.
- C. Moisture-Retaining Sheet: ASTM C171.
1. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
- D. Water: Potable, not detrimental to concrete.

### 2.8 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.
- B. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

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- C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ independent testing agency acceptable to Structural Engineer for preparing and reporting proposed mix designs.
- D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- E. Normal Weight Concrete:
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: See structural drawings notes section D.
  - 2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight.
  - 3. Water-Cement Ratio: Maximum 0.45 percent by weight except for slab on grade the maximum shall be 0.50.
  - 4. Total Air Content: 5% +/- 1% for footings and 6% +/- 1% for foundation walls and exterior concrete, determined in accordance with ASTM C173/C173M.
  - 5. Maximum Slump: 3 inches, additional workability may be achieved with an approved admixture that does not promote shrinkage of the concrete.
  - 6. Maximum Aggregate Size: 3/4 inch.

### 2.9 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: Do not add water on site.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

### 3.2 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

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- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent according to bonding agent manufacturer's instructions.
  - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
  - 2. Use latex bonding agent only for non-load-bearing applications.
- E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

### 3.3 UNDERSLAB VAPOR BARRIER:

- A. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade at locations where moisture sensitive flooring will be placed. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
  - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
- B. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
- C. Place vapor retarder over subbase immediately prior to placing of slabs on grade. Install vapor retarder in accordance with ASTM E1643 and Manufacturer's printed instructions. Vapor retarder shall be continuous over entire floor area (where determined necessary due to floor finishes) and turned up a minimum of 2 inches at perimeter walls and penetrations. Tears, punctures and penetrations shall be taped to maintain the moisture vapor resistance integrity of vapor retarder.
  - 1. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.
- D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- E. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
- F. Extend vapor barrier over footings and grade beams to a distance acceptable to the Structural Engineer or stop at impediments such as dowels and waterstops.
- G. Seal vapor barrier to foundation wall, grade beam, or slab at an elevation consistent with the top of the slab or terminate at impediments such as waterstops or dowels.
- H. Overlap joints 6 inches and seal with manufacturer's seam tape.

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- I. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
- J. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

### 3.4 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection as specified on structural drawings.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

### 3.5 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect and Structural Engineer not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### 3.6 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
  - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Load Transfer Construction and Control Joints: Install load transfer devices as indicated on structural drawings; saw cut joint at surface as indicated on structural drawings for control joints. Use slab joint

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protectors at intersections of all sawcut joints to prevent cross direction cut from spalling adjacent slab joint corner.

- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, immediately following finishing operations; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- F. Construction Joints: Diamond dowels per structural drawings.
- G. Reinforcing shall be continuous through construction joints, Provide shear keys as detailed.

### 3.7 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for compliance with specified tolerances.
- B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
  - 1. Exposed to View and Foot Traffic: F(F) of 50; F(L) of 40, on-grade only.
  - 2. Under Carpeting: F(F) of 35; F(L) of 25, on-grade only.
  - 3. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.
- C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 72 hours after slab installation; report both composite overall values and local values for each measured section.
- D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### 3.8 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height. Rough wood float finish.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
  - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
  - 2. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.
- D. Concrete Slabs on Grade: Finish to requirements of ACI 302.1R, and as follows:

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1. All slabs-on-grade shall have a monolithic placement. Screed concrete to accurate level grades and float to a uniform level surface.
  2. Steel trowel with self-propelled troweling machines to a smooth, dense, hard finish. Do not burnish trowel or over-trowel surfaces with hardener. Surface shall be free from depressions, trowel marks, scale, and foreign deposits.
  3. Delay final troweling until after sheen has completely disappeared. Dusting will not be permitted under any circumstances.
  4. Depress slabs where shown on Drawings. Coordinate with gym flooring.
- E. Chemical Hardener: See Section 03 3511.
- F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.
- G. Concrete Polishing: See Section 03 3511.

### 3.9 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
1. Normal concrete: Not less than seven days.
  2. High early strength concrete: Not less than four days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Interior Floor Slabs – Slabs on Grade:
1. Apply one coat of VC-5 by Sinak (or an approved equal) as soon as permitted by the manufacturer recommendations. Apply at a rate of 300 sf/gallon or as recommended by the manufacturer. Apply a second coat (perpendicular to the first coat to create a crosshatch pattern) immediately after the first coat is dry to the touch, consult manufacturer for all recommendations prior to product installation.

### 3.10 FOUNDATIONS FOR POLES

- A. Concrete Pole Foundations:
1. Foundations shall be cast-in-place exterior concrete, having 4500 psi minimum, 28-day compressive strength.
  2. Foundations shall be as detailed on the structural drawings.
- B. Rub-finish and round all above-grade concrete edges to approximately 6 mm (0.25-inch) radius.

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- C. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
  - 1. Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.
- D. Prior to concrete pour, install electrode per Section 26 0526 - Grounding and Bonding for Electrical Systems.

### 3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified on structural drawings.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements, refer to ASTM C172.
- E. Compressive Strength Tests: ASTM C39/C39M & ASTM C31/C31M, for each test, mold and cure four 6"x12" or five 4"x8" concrete test cylinders. Samples shall be obtained for each concrete class or mixture at least one per day, at least for each 150 cubic yards of concrete placed, and at least for each 5000 square feet of surface area for slabs or walls.
- F. Take at least two additional 6"x12" or three 4"x8" test cylinders during cold weather concreting, cured on job site under same conditions as concrete they represent. Tested in accordance with and Field curing procedure in accordance with ASTM C39/C39M & ASTM C31/C31M, respectively.
- G. Prior to the addition of plasticizer, perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Entrained Air Tests: Freshly mixed concrete shall be tested for air content in accordance with ASTM C231 and reported with compression test reports. Air, when required, is to be per section 2.8. Test air content for each exterior flatwork pour and any time the concrete mix is air-entrained.
- I. Unit Weight and Yield Tests: ASTM C138/C138M, Perform unit weight test and yield test for each set of specimens obtained.

### 3.12 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements in ACI, the specification or the contract documents..
- C. Repair or replacement of defective concrete will be determined by the Architect and Structural Engineer. The cost of repair or replacement or additional testing shall be borne by Contractor when defective concrete is identified.

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- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect and Structural Engineer for each individual area.

**3.13 PROTECTION**

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

**END OF SECTION 03 3000**



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**SECTION 03 3511  
CONCRETE FLOOR FINISHES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Liquid densifiers and hardeners.
- B. Polished concrete.
- C. Surface treatment with concrete hardener and sealer.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.
- C. Section 09 0561 - Common Work Results for Flooring Preparation.

**1.3 REFERENCE STANDARDS**

- A. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
- B. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2019.
- C. National Floor Safety Institute:
  - 1. NFSI B101.1-2020 - Test Method for Measuring the Wet SCOF of Hard-Surface Walkways.
  - 2. NFSI B101.3-2020 - Test Method for Measuring the Wet DCOF of Hard Surface Walkways.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with concrete floor placement and concrete floor curing.

**1.5 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Product Data: Manufacturer's published data and installation instructions for concrete polishing system and finishing products, including manufacturer's installation instructions, information on compatibility of different products, and limitations.
- D. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

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- E. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Specimen Warranty: Manufacturer warranty.
- G. Manufacturer's Certification: Submit manufacturer's ISO 9001/9002 certification.

### 1.6 QUALITY ASSURANCE

- A. For slabs indicated to receive concrete polishing system, do not proceed with concrete polishing unless manufacturer's representative and specialized equipment is present for every day of placement.
- B. Applicator Qualifications: Applicator must have prior experience applying specified product or similar products, or have manufacturer's representative on site ensuring that preparation and application are performed correctly.

### 1.7 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may not remain as part of the work.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.
- B. Store in cool dry area. Protect from freezing.

### 1.9 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.

### 1.10 WARRANTY

- A. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not

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changed, as determined by the Architect.

1. L&M Construction Chemicals, Inc.; 14851 Calhoun Road, Omaha, NE 68152 800-362-3331; www.lmcc.com
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed. submit as substitution according to Conditions of the Contract and Division 1 Sections.
  1. W. R. Meadows®, Inc., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. www.wrmeadows.com.
  2. The Euclid Chemical Company, 19218 Redwood Road, Cleveland, Ohio 44110. (800)321-7628. Phone (216) 531-9222. Fax (216) 531-9596. www.euclidchemical.com.
  3. US MIX Co., 112 South Santa Fe Drive, Denver, CO 80223, 800-397-9903, www.usspec.com.
  4. BasF Corporation Building systems, 889 Valley Park Drive Shakopee, MN, 55379, 800-433-9517, www.BuildingSystems.BASF.com
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 MATERIALS

- A. Performance Based Specification: Water-based acrylic curing and sealing compound shall be a non-yellowing, clear, acrylic curing and sealing compound meeting the following requirements:
  1. ASTM C309, Type 1, Class B
  2. ASTM C1315, Type I Class A, Section 6.4.1 - non-yellowing.
  3. ASTM C1315, Section 6.6 - exceed 50 MPa (70 psi) adhesion requirements
  4. ASTM D2047 slip-resistance requirements.

### 2.3 CONCRETE FLOOR FINISH APPLICATIONS

- A. Type F-1: Liquid Densifier and Hardener:
  1. Use at following locations: All exposed concrete floors. Refer to Drawings Room Finish and Material Schedules.
- B. Type F-2: Polished Finish:
  1. Use at following locations: As indicated on Drawings.

### 2.4 DENSIFIERS AND HARDENERS

- A. Liquid Densifier/Hardener: Type F-1: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
- B. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

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1. Composition: Sodium silicate.
  - a. Products:
    - 1) L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; SEAL HARD: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
    - 2) SpecChem, LLC; SpecHard: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - 3) W. R. Meadows, Inc; Liqui-Hard: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - 4) Or Approved Equal.

### 2.5 POLISHED CONCRETE SYSTEM

A. Type F-2 - Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

1. Basis of Design: Chemical Hardener/Densifiers:
  - a. L.M. Scofield Company; SCOFIELD Formula One Ground & Polished Concrete Systems; SCOFIELD® Formula One™ Lithium Densifier MP; SCOFIELD® Formula One™ Guard-W: [www.scofield.com](http://www.scofield.com).
2. Gloss:
  - a. Class 2 - Medium Gloss (Reflectivity) - (specified as 800 grit) at a distance of 30 to 50 feet, the floor will clearly reflect from side and overhead lighting.
3. Aggregate Exposure:
  - a. Grade 2 - Salt & Pepper – sand is exposed
4. Acceptable Systems:
  - a. Ameripolish, Inc; Ameripolish Polished Concrete System: [www.ameripolish.com/#sle](http://www.ameripolish.com/#sle).
  - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; FGS Permashine Concrete Polishing System: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
  - c. PROSOCO, Inc; Consolideck Polished Concrete System: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

### 3.2 GENERAL

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- A. Apply materials in accordance with manufacturer's instructions.

### 3.3 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive curing and sealing compound.
- B. Clean and prepare surfaces to receive curing and sealing compound in accordance with manufacturer's instructions.
- C. Ensure concrete surface is clean and dry, with all stains, oil, grease, dust, and dirt removed.
- D. Concrete surface water should be dissipated when used on new concrete.
- E. Concrete surfaces should not be marred by walking workers.

### 3.4 APPLICATION

- A. Apply curing and sealing compound in accordance with manufacturer's instructions.
- B. Ensure product is mixed for optimum performance. Avoid aggressive mixing as foaming may occur.
- C. Use an industrial sprayer with a 5916 tip that produces a flow rate of 1/10 of one gallon per minute.
- D. Alternatively apply using a lint-free roller or lamb's wool roller.
- E. Avoid puddling in low areas.

### 3.5 FLOOR SEALER

- A. At areas indicated on Drawings, provide 2 coats of sealer.
- B. Surface must be clean, dry and free of loose dirt, oil, wax, curing and parting compounds and other foreign matter.
- C. Apply each coat in accordance with Manufacturer's printed instructions.

### 3.6 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

### 3.7 POLISHED CONCRETE APPLICATION

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- A. Applicator shall examine the areas and conditions under which work of this section will be provided and the General Contractor shall correct conditions detrimental to the timely and proper completion of the work and the Applicator shall not proceed until unsatisfactory conditions are resolved.
- B. Grind the concrete floor to within 2 - 3 inches of walls with 16, 25, 40, 60, 80 and/or 150 grit removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure.
- C. Apply material approved by architect for color effects in accordance with the architectural drawings and the manufacturer's recommended guidelines.
- D. Fill construction joints and cracks with filler products as specified in accordance with manufacturer's instructions colored to match (or contrast) with concrete color as specified by architect.
- E. Apply densifying impregnator undiluted at approximately 200 square feet per gallon using a stiff, long bristled broom. Cover the entire area liberally. Using a broom, work the densifier into the substrate for 30 minutes. During this 30-minute period, continually keep the substrate wet with densifier. Squeegee excess material off the floor. Allow 12 to 24 hours for full cure.
- F. Grind the floor to within 2 - 3 inches of walls with metal bonded diamond grits of 150 and 300-grinding 90 degrees from each previous grind and removing all the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- G. (If specified) Grind the edges with 40, 60, 120 and 220 grit grinding pads removing all of the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- H. Polish the floor, to desired sheen level, with phenolic resin bonded diamond grits of 100, 400, 800, 1500 and 3000-first polishing the edges (if specified) with pads of the same grit and then the field of the floor removing all scratches from the previous grit. After each polish, clean the floor thoroughly using clean water and an auto scrubber or a mop and a wet vacuum.
- I. After the floor has dried, apply densifier at a rate of 300 square feet per gallon. Using a broom, work the material into the floor for a minimum of 10 minutes. Tight squeegee the remaining material from the floor without leaving squeegee marks or puddles. Allow to cure for 12 - 24 hours.
- J. Using a high speed (2000 - 3000 rpm) burnishing machine and hogs hair burnishing pad, buff the surface to a high shine.
- K. Upon completion, the work shall be ready for final inspection and acceptance by the Architect and Owner.

### PROTECTION

- L. Restrict foot traffic for at least four hours; 12 hours is preferable.
- M. Protect finished surface as required and as recommended by manufacturer of polishing system.

**END OF SECTION 03 3511**

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**SECTION 04 2000  
UNIT MASONRY**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Accessories.
- F. Cleaning.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 5000 - Metal Fabrications: Fabricated steel items.
- B. Section 07 2100 - Building Insulation: Insulation for cavity spaces.
- C. Section 07 2726 - Fluid-Applied Membrane Air Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.
- F. Section 09 9600 - Anti-Graffiti Coatings for Waterproofing and anti-graffiti coating.

**1.3 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- C. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2022a.
- D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2022.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2023.
- G. ASTM C91/C91M - Standard Specification for Masonry Cement 2023.

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- H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2023.
- I. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2023a.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- K. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- O. ASTM C426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units; 2016.
- P. ASTM C476 - Standard Specification for Grout for Masonry 2023.
- Q. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2023.
- R. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength 2022.
- S. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar 1992a (Reapproved 2014).
- T. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms 2023b.
- U. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.
- V. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a (Reapproved 2019).
- W. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry 2020.
- X. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.
- Y. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022, with Errata.

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, reinforcement, mortar, grout and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, size and spacing of reinforcing, and layout.
  - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.

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2. Include the design engineer's stamp or seal on each sheet of shop drawings.
- D. Samples: Submit four samples of masonry units to Architect to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- F. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- G. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- H. Designer's Qualification Statement.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.

### 1.5 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum 10 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

### 1.6 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, reinforcement, wall openings, flashings (with lap joint, corner, and end dam), weather barrier, wall insulation, and an expansion joint, a crossover location between alternating wall types and wall insulation in mock-up.
- B. Location of mock up panel to be coordinated with Architect and Contractor.
- C. Mock-up may remain as part of the Work.

### 1.7 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

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1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
  1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

### 1.9 DESIGN STRENGTH

- A. Masonry Design Strength:  $F'm = 2000$  psi

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS:

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Basis of Design Manufacturer:

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1. Basalite Sparks, 355 Greg Street, Sparks, NV 89431 Tel: 775-358-1200. Email contact: gary.indiano@paccoast.com

### 2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

### 2.3 CONCRETE MASONRY UNITS

- A. Concrete Block Type: Comply with referenced standards and as follows:
  1. Basis of Design: Type-CMU-1, CMU-2, CMU-3: Basalite Precision Concrete Masonry Units.
  2. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 and 12 inches as indicated on Drawings.
  3. Texture (s): As indicated on Drawings.
  4. Special Shapes: Provide non-standard blocks configured for corners.
    - a. Solid Concrete Masonry Caps: To match CMU type/color. Height: 2 inch high units.
  5. Load-Bearing Units: ASTM C90, medium weight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's color's and texture's as indicated on architectural plans.
    - c. Pattern: Running Bond unless otherwise noted on plans.
  6. Non-Loadbearing Units: ASTM C129.
    - a. Hollow block, as indicated.
    - b. Medium weight.

### 2.4 MORTAR AND GROUT MATERIALS FOR BLOCK

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  1. Do not use calcium chloride in mortar or grout.

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2. Use Portland cement-lime masonry cement mortar unless otherwise indicated.
  3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Masonry Cement: ASTM C91/C91M, Type S.
- C. Portland Cement: ASTM C150/C150M, Type II; except Type III may be used for cold- weather construction, color as required to produce approved color sample.
1. Not more than 0.10 percent alkali.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Mortar Aggregate: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Grout Aggregate: ASTM C404.
- G. Water: Clean and potable.
- H. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason's sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Type: Type M or S.
  2. Color: Standard gray.
- I. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only. Meet requirements for Coarse Grout. Grout shall attain a minimum compressive strength of 2000 PSI at 28 days and not less than specified F'm.
1. Type: Coarse.

### 2.5 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars. Utilize ASTM A706/A706M, Grade 60 (60,000 psi), deformed bars where reinforcing is to be welded.
- B. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar

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coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

- C. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
  - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
  - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
  - 3. Vertical adjustment: Not less than 3-1/2 inches.
  - 4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

### 2.6 FLASHINGS

- A. Metal Flashing Materials: Galvanized, as specified in Section 07 6200.

### 2.7 ACCESSORIES

- A. Preformed Control Joints: Per Structural detail on plans.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC- 65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

### 2.8 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Masonry mortar: Type M or S.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; utilize course grout.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
  - 1. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

### 2.9 CLEANING MATERIALS

- A. Basis of Design Manufacturer:
  - 1. Diedrich Technologies, A Hohmann & Barnard Company, [www.diedrichtechnologies.com](http://www.diedrichtechnologies.com).

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2. Product Name: Eco-Scrub™ Mineral Acid Free Masonry Cleaner
- B. Acceptable Manufacturers:
  1. PROSOCO; Sure Klean cleaning and protective treatments for Masonry and Brick: [www.prosoco.com/#sle](http://www.prosoco.com/#sle).
  2. or Approved Equal.
- C. Substitutions: See Section 01 6000 - Product Requirements.
- D. Cleaning Agent: Detergent type.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

#### 3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work as necessary and maintain bracing until masonry has cured to full design strength.

#### 3.3 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

#### 3.4 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  1. Bond: Running.
  2. Coursing: One unit and one mortar joint to equal 8 inches.
  3. Mortar Joints: Concave.

#### 3.5 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.

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- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Perform low lift construction with maximum grout pour height of 5'-4" unless proper cleanouts are planned and achieved for high lift grouting. Notify architect if high lift grouting is planned.
- I. Cells shall be in vertical alignment. Dowels in footings shall be set to align with cores containing reinforcing steel.
- J. Leave the top of grout pours recessed 1-1/2" and pour successive grout pour in the recess to achieve bonding.

### 3.6 CAVITY MORTAR CONTROL

- A. Do not permit excessive mortar to drop or accumulate in grout void. Provide a minimum of 1/2" grout between main reinforcing and masonry units. Mortar fin projections larger than 1/4" from the interior face of CMU block to be knocked off prior to grouting.

### 3.7 GROUTED COMPONENTS

- A. Reinforce bond beams per Structural details.
- B. Lap splices per structural drawings.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.

### 3.8 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints except as shown on structural drawings (at roof and floor level chords).
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joints as indicated on drawings.
- D. Form expansion joint as detailed on drawings.

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### 3.9 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### 3.11 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Alignment of Columns: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.



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### 3.12 CUTTING AND FITTING

- A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in on Structural Drawings.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.
- D. Prism Tests: Test each prism in accordance with ASTM C1314 or per structural drawings.
  - 1. A set of five masonry prisms shall be built and tested in accordance with ASTM C1314 or an approved equal ASTM standard test method prior to the start of construction. Materials used for the construction of the prisms shall be taken from those specified to be used in the Project. Prisms shall be constructed under the observation of the engineer or special inspector or an approved agency and tested by an approved agency.
  - 2. A set of three (3) prisms shall be built and tested during construction in accordance with ASTM C1314 or an approved equal ASTM standard test method for each 5,000 square feet of wall area, but not less than one (1) set of three (3) prisms for the Project.
  - 3. Make report of test results in writing and expedited to Contractor, Architect, Owner, and the Structural Engineer. Include in test reports the project identification name and number, date, name of subcontractor, name of testing service and identification number.

### 3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
  - 1. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
  - 2. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
  - 3. Clean surrounding surfaces.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

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1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
6. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.
7. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

### 3.15 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION 04 2000**

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**SECTION 05 1200  
STRUCTURAL STEEL FRAMING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Structural steel framing members.
- B. Structural steel support members and struts.
- C. Base plates, shear stud connectors and expansion joint plates.
- D. Grouting under base plates.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

**1.3 REFERENCE STANDARDS**

- A. AISC (MAN) - Steel Construction Manual 2023.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2022.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2023.
- H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.
- I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2022.
- J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

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- L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- M. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2020.

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners. Indicate all bolt sizes, bolt holes, weld locations and sizes, and grades of all materials used.
  - 2. Verify all dimensions with architectural and structural drawings.
  - 3. Connections not detailed.
  - 4. Indicate cambers as shown on structural drawings.
  - 5. Indicate all connections as shown on structural drawings.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
- E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.
- F. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied if indicated on structural drawings.
- G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### 1.5 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator: Company specializing in performing the work of this section with minimum 10 years of documented experience.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- D. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Steel Angles, Channels, Bars, and Plates: ASTM A36/A36M.
- B. Steel W Shapes and WT Shapes: ASTM A992/A992M.
- C. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50 where indicated on Structural Drawings.
- D. Structural HSS Tubing: ASTM A500/A500M, Grade C.
- E. Pipe: ASTM A53/A53M, Grade B.
- F. Shear Stud Connectors (Headed Studs): Nelson Stud Anchors (or approved equal). In compliance with ASTM A108.  $F_u = 65$  ksi..
- G. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
- H. Structural Bolts, Nuts, and Washers (designated A325N bolts on plans): All nuts and bolts in structural steel connections shall be Per ASTM F1852, twist off type tension control, with hardened washers.
- I. Anchor Bolts: ASTM F1554 Gr. 36, unless noted otherwise on structural drawings.
- J. Welding Materials: E70XX, low hydrogen electrodes.
- K. Grout: See section 033000, 2.5.B.
- L. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- M. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

**2.2 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Space shear stud connectors as shown on Structural Drawings.
- C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- D. Fabricate connections for bolt, nut, and washer connectors.
- E. Develop required camber for members.

**2.3 FINISH**

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- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

### 2.4 SOURCE QUALITY CONTROL

- A. Provide special inspection as shown on the structural drawings.
- B. Testing and inspection shall be in accordance with AISC 360 and AWS standards.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

### 3.2 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components as indicated on shop drawings and structural drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Structural Engineer.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

### 3.3 TOLERANCES

- A. Erection tolerances shall be in accordance with AISC standards and AISC 303.

### 3.4 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements and on the Structural Drawings.

## END OF SECTION 05 1200

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**SECTION 05 2100  
STEEL JOIST FRAMING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for floor and roof openings greater than 18 inches.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 1200 - Structural Steel Framing: Superstructure framing.
- C. Section 05 3100 - Steel Decking: Bearing plates and angles.
- D. Section 05 3100 - Steel Decking: Support framing for openings less than 18 inches in decking.
- E. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

**1.3 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.
- C. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2011.
- D. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).
- F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- G. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders 2020.
- H. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders 2008.
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

**1.4 SUBMITTALS**

**Steel Joist Framing - 05 2100**

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- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments. Indicate special loading as designated on the structural drawings. Shop drawings shall be submitted to Architect and Structural Engineer for approval prior to any fabrication.
- C. Engineering Calculations: Engineering calculations stamped by a Nevada licensed civil or structural engineer shall be submitted to Architect and Structural Engineer for approval prior to any fabrication.
- D. Joist Design: See structural drawings for joist design criteria and joist loading requirements. Design joists for all loads as shown on structural drawings, including but not limited to top chord axial loads, vertical loading as shown, add live loads as shown, wind uplift as shown, joist seat wall anchorage axial loads and special loading from mechanical units and other items on or hung from roof structure.
- E. Designer's Qualification Statement.
- F. Manufacturer's Qualification Statement.
- G. Fabricator's Qualification Statement.
- H. Erector's Qualification Statement.

### 1.5 QUALITY ASSURANCE

- A. Design joists and all bridging connections not detailed on drawings under direct supervision of a Professional Structural or Civil Engineer experienced in design of this work and licensed in Nevada.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.
- C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 10 years documented experience.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Steel Joists:
  - 1. Canam Group Inc: [www.canam-steeljoists.ws](http://www.canam-steeljoists.ws)

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2. Nucor-Vulcraft Group: [www.vulcraft.com](http://www.vulcraft.com).
3. New Millennium Building Systems: [www.newmill.com](http://www.newmill.com)
4. Valley Joist Inc. : [valleyjoist.com](http://valleyjoist.com)
5. Substitutions: 012500 - Substitution Procedures.

### 2.2 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
  1. Provide bottom chord extensions as indicated.
  2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
  3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
  4. Finish: Shop primed.
  5. Joist seat depths as indicated on structural drawings.
- B. Open Web Joists: SJI 100 Type LH Joists:
  1. Provide bottom chord extensions as indicated.
  2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
  3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
  4. Finish: Shop primed.
  5. Joist seat depths as indicated on structural drawings.
- C. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325N with hardened washers.
- D. Tension Control Bolts: Twist-off type; ASTM F1852.
- E. Shear Stud Connectors: ASTM A108.
- F. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### 2.3 FABRICATION

- A. Fabricate joists to comply with the maximum depths as shown on the structural drawings.

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B. All open web joists shall be shop painted and touched up in the field after erection.

### 2.4 FINISH

A. Provide shop coat as indicated. Touch up in the field after erection.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

### 3.2 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld or bolt joist seats to steel bearing surfaces as shown on shop drawings and structural drawings.
- E. Install supplementary framing for floor and roof openings greater than as indicated on Structural Drawings.
- F. All joists shall have bridging as shown on the structural drawings and as recommended by the steel joist institute.
- G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- H. Do not field cut or alter structural members without approval of joist manufacturer.
- I. After erection, prime welds, damaged shop primer, and surfaces not shop primed, except surfaces specified not to be primed.

### 3.3 TOLERANCES

A. Erection tolerances shall be in accordance with AISC standards, SJI standards and AISC 303.

### 3.4 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Erection tolerances shall be in accordance with AISC standards, SJI standards and AISC 303.

## END OF SECTION 05 2100

### Steel Joist Framing - 05 2100

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**SECTION 05 3100  
STEEL DECKING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Acoustical steel roof deck.
- B. Roof deck.
- C. Supplementary framing for openings up to and including 18 inches.
- D. Bearing plates and angles.
- E. Acoustical insulation in roof deck flutes.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.
- B. Section 04 2000 - Unit Masonry: Placement of anchors for bearing plates embedded in unit masonry assemblies.
- C. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.
- D. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.
- E. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.
- F. Section 26 0533.16 - Boxes for Electrical Systems: Electrical, telephone, floor outlets, sleeves, and gaskets.

**1.3 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).
- E. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- F. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks 2007.
- G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

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H. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
  - 2. Acoustical roof deck.
- D. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- E. Certificates: Certify that products furnished meet or exceed specified requirements.
- F. Submit manufacturer's installation instructions.
- G. Designer's Qualification Statement.
- H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### 1.5 QUALITY ASSURANCE

- A. Quality assurance shall be as indicated on structural drawings, unless noted otherwise.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Steel Deck:
  - 1. ASC Steel Deck: [www.ascsd.com](http://www.ascsd.com).
  - 2. Nucor-Vulcraft Group: [www.vulcraft.com/#sle](http://www.vulcraft.com/#sle).

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3. Verco Decking, Inc.: [www.vercodeck.com](http://www.vercodeck.com).
- B. Acoustical Deck:
  1. Epic Metals Corporation: [www.epicmetals.com](http://www.epicmetals.com).
- C. Substitutions: See Section 01 2500 - Substitution Procedures.

### 2.2 STEEL DECK

- A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G60/Z180 galvanized coating.
  2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
  3. Structural Properties:
    - a. Section modulus: Positive,  $S_p=0.68$  cubic inches per foot, Negative,  $S_n=0.76$  cubic inches per foot..
    - b. Span Design: Double minimum.
  4. Minimum Base Metal Thickness: 20 gauge, 0.0358 inch.
  5. Nominal Height: 3-1/2 inch.
  6. Profile: Epicore ER3.5A-20.
  7. Formed Sheet Width: 24 inch.
  8. Side Joints: Per Structural Drawings.
  9. End Joints: Per Structural Drawings.
  10. Acoustical Perforations: Deck units with manufacturer's standard perforated bottom.
    - a. Non-Perforated Deck: to match description as indicated in this Section without perforations. Refer to Drawings for locations.
  11. Acoustical Insulation: Glass fiber type, minimum 1 lb./cu.ft. density, profiled to suit deck, meeting IBC requirements for exposed insulation material, factory installed into deck cells.
- B. Roof Deck: Non-composite type, fluted steel sheet:
  1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G60/Z180 galvanized coating.

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2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
3. Structural Properties:
  - a. Section Modulus: +Seff=0.314 cubic inch per foot, -Seff=0.331 cubic inch per foot.
  - b. Span Design: Double minimum.
4. Minimum Base Metal Thickness: 18 gauge, 0.0474 inch.
5. Nominal Height: 1-1/2 inch.
6. Profile: PLB-36.
7. Formed Sheet Width: 36 inch.
8. Side Joints: Per Structural Drawings.
9. End Joints: Per Structural Drawings.

### 2.3 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
- B. Fasteners: Galvanized hardened steel, self-tapping where indicated on Structural Drawings.
- C. Powder Actuated Mechanical Fasteners: Provide the fasteners with diameters, types and patterns as indicated on the structural drawings
- D. Mechanical Fasteners: Provide the fasteners with diameters, types and patterns as indicated on the structural drawings.
  1. Design Requirements for Sidelap Connections: Provide the connections and patterns as indicated on the structural drawings
  2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.
  3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
- G. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.
- H. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck. Only required at acoustical decking locations.

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### 2.4 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.
- B. Cant Strips: Formed sheet steel, 20 gauge, 0.0358 inch minimum thickness, 45 degree slope, 3-1/2 inch nominal width and height, flange for attachment.
- C. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.
- D. Floor Drain Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On concrete and masonry surfaces provide minimum 4 inch bearing.
- C. On steel supports provide minimum 2 inch bearing.
- D. Fasten deck to steel support members.
- E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- F. Fasten side laps with mechanical fasteners where indicated on structural drawings.
- G. Weld deck in accordance with AWS D1.3/D1.3M where required.
- H. Reinforce deck openings as details on structural drawings indicate.
- I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
- K. Place metal cant strips in position and fusion weld.
- L. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- M. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

**END OF SECTION 05 3100**

**Steel Decking - 05 3100**

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**SECTION 05 4000  
COLD-FORMED METAL FRAMING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Formed steel stud exterior wall, interior wall, and soffit framing.
- B. Formed steel joist and purlin framing and bridging.

**1.2 RELATED REQUIREMENTS**

- A. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.
- B. Section 09 2216 - Non-Structural Metal Framing.
- C. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

**1.3 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2023.
- D. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018, with Editorial Revision.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories 2020.
- F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).
- H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).
- I. PS 1 - Structural Plywood 2022.
- J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

**Cold-Formed Metal Framing - 05 4000**

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### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, and imitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
  - 1. Indicate stud and ceiling joist layout.
  - 2. Describe method for securing studs to tracks and for bolted framing connections.
  - 3. Design data:
    - a. Shop drawings signed and sealed by a professional structural engineer.
  - 4. Calculations for loadings and stresses of specially fabricated framing, signed and sealed by a professional structural engineer.
  - 5. Match detailing on structural drawings.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.
- F. Designer's Qualification Statement.
- G. Manufacturer's Qualification Statement.
- H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.

### 1.6 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Nevada.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum 10 years of documented experience.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

## PART 2 PRODUCTS

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### 2.1 MANUFACTURERS

- A. Metal Framing:
  - 1. CEMCO: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
  - 2. ClarkDietrich: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 3. SCAFCO Corporation: [www.scafco.com/#sle](http://www.scafco.com/#sle).
- B. Framing Connectors and Accessories:
  - 1. Same manufacturer as metal framing.
- C. Substitutions: 012500 - Substitution Procedures.

### 2.2 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Shop fabricate framing system to the greatest extent possible.
- C. Deliver to project site in largest practical sections.

### 2.3 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; track in matching nominal width and compatible height.
  - 1. Gauge and Depth: As indicated on drawings.
  - 2. Galvanized in accordance with ASTM A653/A653M, G60/Z180 coating.
  - 3. Provide components fabricated from ASTM A1008/A1008M Designation SS (structural steel).
- B. Jamb Studs: Engineered, C-shaped with wide flanges, designed to replace conventional double-stud framing at openings.
- C. Header: As indicated on drawings.
  - 1. Jamb Mounting Clips: Manufacturer's standard.
  - 2. Cripple Stud Clips: Manufacturer's standard.
- D. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
- E. Framing Connectors: Factory-made, formed steel sheet.
  - 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch, and factory punched holes and slots.

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2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
  - a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
  - b. Provide top track with long leg track and head of wall movement connectors; minimum track length of 10 feet.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
4. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

### 2.4 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Welding: Comply with AWS D1.1/D1.1M.

### 2.5 WALL SHEATHING

- A. Plywood; PS 1, Grade C-D, Exposure I.
- B. Gypsum Board Wall Sheathing: See Section 09 2116.

### 2.6 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- C. Water-Resistive Barrier: See Section 07 2500.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

### 3.2 INSTALLATION OF STUDS

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- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners per Structural Drawings. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at spacings per Structural Drawings; not more than 16 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method per drawings.
- D. Construct corners using minimum of three studs. Install studs at wall openings per drawings.
- E. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- G. Install intermediate studs above and below openings to align with wall stud spacing.
- H. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- I. Attach cross studs to studs for attachment of fixtures anchored to walls.
- J. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- K. Touch-up field welds and damaged galvanized surfaces with primer.

### 3.3 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at spacings per drawings and connect joists to supports using fastener method.
- D. Locate joist end bearing directly over load-bearing studs or provide load distributing member to top of stud track.
- E. Provide web stiffeners at framing where required on drawings.
- F. Touch-up field welds and damaged galvanized surfaces with primer.

### 3.4 INSTALLATION OF WALL SHEATHING

- A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
  - 1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.
  - 2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges, and ends.

### 3.5 TOLERANCES

- A. Maximum Variation from True Position: 1/2 inch.

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B. Maximum Variation of any Member from Plane: 1/2 inch.

**END OF SECTION 05 4000**

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**SECTION 05 5000  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Shop fabricated steel and aluminum items.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
- E. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
- F. Section 05 5100 - Metal Stairs.
- G. Section 05 5133 - Metal Ladders.
- H. Section 05 5213 - Pipe and Tube Railings.

**1.3 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

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- I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- M. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2019a.
- N. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- O. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- P. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2023.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).
- T. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).
- U. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- W. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- X. SSPC-SP 2 - Hand Tool Cleaning 2018.

### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

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1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
  - a. Include the following, as applicable:
    - 1) Design criteria.
    - 2) Engineering analysis depicting stresses and deflections.
    - 3) Member sizes and gauges.
    - 4) Details of connections.
    - 5) Support reactions.
    - 6) Bracing requirements.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### 1.5 QUALITY ASSURANCE

- A. Design shall be under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Nevada.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

## PART 2 PRODUCTS

### 2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

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- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### 2.2 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Steel, galvanized to ASTM A153/A153M.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

### 2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### 2.4 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gauge, 0.0478 inch minimum base metal thickness; galvanized finish.
- C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- D. Lintels: As detailed; prime paint finish.
- E. Door Frames for Overhead Door Openings and Wall Openings: Channel and Angle sections; prime paint finish.

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- F. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
- G. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.
- H. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

### 2.5 FINISHES - STEEL

- A. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

### 2.6 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Class I color anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.
- C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- D. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick; light bronze.
- E. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick; light bronze.
- F. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.
- G. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.
- H. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

### 2.7 FABRICATION TOLERANCES

#### Metal Fabrications - 05 5000

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- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

#### **3.2 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

#### **3.3 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

#### **3.4 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION 05 5000**

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**SECTION 05 5133  
METAL LADDERS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Shop-fabricated metal ladders.
- B. Prefabricated ladders.

**1.2 REFERENCE STANDARDS**

- A. 29 CFR 1910.23 - Ladders Current Edition.
- B. 29 CFR 1926.1053 - Ladders Current Edition.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- D. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- I. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- K. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).
- M. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).
- N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- P. SSPC-SP 2 - Hand Tool Cleaning 2018.

**1.3 SUBMITTALS**

## City of Sparks - Fire Station #6

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### 1.4 QUALITY ASSURANCE

- A. Design work under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Nevada.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

## PART 2 PRODUCTS

### 2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

### 2.2 MATERIALS - ALUMINUM

### 2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.

### Metal Ladders - 05 5133

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- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### 2.4 FABRICATED LADDERS

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
  - 1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
  - 2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
  - 3. Space rungs 7 inches from wall surface.

### 2.5 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
  - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
  - 2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
  - 3. Finish: Mill finish aluminum.
  - 4. Manufacturers:
    - a. O'Keeffe's Inc: Model 532: [www.okeeffes.com/#sle](http://www.okeeffes.com/#sle).
    - b. Precision Ladders, LLC: [www.precisionladders.com/#sle](http://www.precisionladders.com/#sle).
    - c. Or Approved Equal.

### 2.6 FINISHES - STEEL

- A. Prime paint steel items.
  - 1. Do not prime surfaces where field welding is required.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

### 2.7 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Class I natural anodized.

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- B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

### 2.8 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

### 3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

### 3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

### 3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

## END OF SECTION 05 5133

**City of Sparks - Fire Station #6**

**SECTION 06 4100  
ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Hardware.
- B. Preparation for installing utilities.
- C. Plastic Laminate.

**1.2 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 6116 - Solid Surfacing Fabrications: Solid polymer fabrications
- C. Section 12 3600 - Countertops.

**1.3 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- F. BHMA A156.9 - Cabinet Hardware 2020.
- G. GSA CID A-A-1936 - Adhesives, Contact, Neoprene Rubber 1996a (Validated 2013).
- H. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- I. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.5 SUBMITTALS**

- A. See Section 013300 - Aluminum Entrances and Storefront Systems, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

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1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  2. Provide the information required by AWI/AWMAC/WI (AWS).
  3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
1. Adhesive manufacturer's product data for each adhesive used indicating that the adhesive contains no urea formaldehyde.
- D. Provide UL approved identification on fire retardant treated material.
- E. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- F. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum 10 years of documented experience.
1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  2. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Single-Source Responsibility for Fabrication and Installation: Engage qualified woodworking firm to assume undivided responsibility for fabricating, finishing, and installing woodwork specified in this Section.
- C. Regulatory Requirements:
1. Flame Spread Index: Where fire-retardant treated wood is specified or required by IBC Chapter 8 requirements, provide materials that have been tested in accordance with ASTM E84 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  2. Fire-retardant treated materials shall be identified with appropriate classification markings indicating rating on surfaces that will be concealed from view in the finished work or by separate removable label applied by the treated wood Manufacturer.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage and moisture while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

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D. Protect units from moisture damage.

**1.8 FIELD CONDITIONS**

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

B. Verify that field measurements are as indicated on Shop Drawings.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

A. Single Source Responsibility: Provide and install this work from single fabricator.

**2.2 CABINETS**

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

**2.3 PANEL CORE MATERIALS**

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

1. Grade: M-2; moisture resistance: MR10.

2. Panel Thickness: 3/4 inch.

B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

1. Grade: 115; moisture resistance: MR10.

2. Panel Thickness: 3/4 inch.

**2.4 LAMINATE MATERIALS**

A. Manufacturers:

1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).

2. Nevamar: [www.nevamar.com](http://www.nevamar.com)

3. Panolam Industries International, Inc; Nevamar: [www.nevamar.com](http://www.nevamar.com).

4. Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).

5. Other manufacturers specifically noted in Drawings.

6. Substitutions: 012500 - Substitution Procedures.

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- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
  - 1. Finishes, colors, patterns and textures as indicated on the Interior Drawings and Specifications and as indicated on the drawings or selected by the Architect.
  - 2. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

### 2.5 COUNTERTOPS

- A. Solid Surface Countertops:
  - 1. Flat Sheet Thickness: 3/4 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Dupont: [www.corian.com/#sle](http://www.corian.com/#sle).
      - 2) LG Hausys America, Inc: [www.lghausysusa.com/#sle](http://www.lghausysusa.com/#sle).
      - 3) Relang International, LLC; DURASEIN: [www.duraseinusa.com/#sle](http://www.duraseinusa.com/#sle).
      - 4) Wilsonart; \_\_\_\_: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. NSF approved for food contact.
    - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - e. Color and Pattern: As indicated on drawings.
  - 3. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick; edge profile as indicated on drawings; use marine edge at sinks.
  - 4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  - 5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
- B. Stainless Steel Countertops: {rs#1}, Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.
- C. Finish: 4B satin brushed finish.

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- D. Exposed Edge Shape: Marine edge with return; edge raised 3/16 inch above counter with 45 degree transition, minimum 1 inch flat rim; 1-1/2 inch high turndown, 1/2 inch return to face of case; reinforced with hardwood or steel.
- E. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
- F. Splash Dimensions: 4 inch high by 1 inch thick, unless otherwise indicated.
- G. Splash Depth Where Faucets are Mounted in Splash: 2 inches.
- H. Sinks: Same material, same thickness; flush welded to counter; bottom sloped to outlet; radiused interior corners; drain outlet located in back corner.

### 2.6 ACCESSORIES

- A. Adhesive: Type recommended to meet AWS Adhesive Guidelines.
  - 1. All adhesive to be formaldehyde free/low VOC in fabrication of all casework.
- B. Wall Adhesive: Cartridge type compatible with paneling and wall substrate.
- C. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's standard range.
  - 2. Use at all exposed plywood edges.
  - 3. Use at all exposed shelf edges.
- D. Fasteners: Size and type to suit application.
- E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- F. Concealed Joint Fasteners: Threaded steel.
- G. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

### 2.7 HARDWARE

- A. Hardware: BHMA A156.9, types as indicated for quality grade specified.
- B. BHMA A156.9, B04071; with shelf rests, B04081 BHMA A156.9, B04102; with shelf brackets, B04112.
- C. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

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- D. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.
- E. Countertop Brackets: Fixed, concealed vertical leg, side-of-stud mounting.
  - 1. Materials: Steel L- and T-shapes.
    - a. Finish: Manufacturer's standard, factory-applied, powder coat.
    - b. Color: Black.
    - c. Vertical Leg: 12 inches.
    - d. Support Member Depth: 1 inch.
    - e. Support Member Width: 1 inch
    - f. Support Member Length: 21 inches.
- F. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.
- G. Cabinet Locks: Keyed cylinder, two keys per lock, steel with satin finish.
  - 1. Base of Design Product: 5E Series 3/4" Utility Cylinder by Best Access.
  - 2. Olympus - No. 100DR for doors and Olympus No. 200DW for drawers.
- H. Cabinet Catches and Latches:
  - 1. Type: Push latch with magnet.
- I. Finish: As indicated on Drawings and Specifications, or if not indicated, as selected by Architect
- J. Drawer Slides:
  - 1. Type: Full extension.
  - 2. Conforming to ANSI/BIFMA X5.6, UL 1678 and UL 1286.
    - a. Light and medium duty drawers -24 inch wide or less: Accuride 7432 ball bearing, rail mount, full extension slides with 100 lb./pr. load rating. Provide Accuride 7434 overtravel slides where drawers require full access.
    - b. Heavy duty drawers - 42 in wide or less: Accuride 3640A ball bearing, rail mount, full extension slides plus 1 inch (25mm) overtravel with 200 lb./pr. load rating.
    - c. Finish: Clear zinc.
  - 3. Static Load Capacity: Commercial grade.
  - 4. Mounting: Side mounted.

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5. Stops: Integral type.
6. Features: Provide self closing/stay closed type.
7. Manufacturers:
  - a. Accuride International, Inc; Heavy-Duty Drawer Slides: [www accuride.com/#sle](http://www accuride.com/#sle).
  - b. Knap & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: [www.knapeandvogt.com/#sle](http://www.knapeandvogt.com/#sle).
  - c. Substitutions: 012500 - Substitution Procedures.
- K. Frameless Concealed Hinges: European style concealed self-closing type, BHMA A156.9, B01602, steel with nickel-plated finish, 170 degree function, self-closing.
  1. Manufacturers:
    - a. Blum, Inc: [www.blum.com/#sle](http://www.blum.com/#sle).
    - b. Hettich America, LP: [www.hettich.com/sle](http://www.hettich.com/sle).
    - c. Or Approved Equal.

### 2.8 SHOP TREATMENT OF WOOD MATERIALS

- A. Provide UL approved identification on fire retardant treated material at or before time of installation
- B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

### 2.9 FABRICATION

- A. Exposed fasteners are not allowed in the finish Work on exposed and semi-exposed surfaces of the case goods.
- B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for scribing. Scribe tolerance is 1/32" max. Scribe trim is not acceptable.
- C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
  1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
  3. Edge Treatment: As detailed.
- D. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing to walls.

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- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges. Extend J-boxes as required by NEC.
- G. Shop glaze glass materials using Interior Dry method; see Section 08 8000.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.
- C. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

#### **3.2 INSTALLATION**

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level. Shim as required with concealed shims. Install to tolerance of 1/8-inch in 96-inches for plumb and level (including tops).
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose. Refinish cut surfaces or repair damaged finish at cuts.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces. When exposed fastening is required to complete installation, exposed fasteners shall be set in quirks, reveals, and reliefs (to be least visible when installation is complete).
- G. Install trim in single lengths without splices where possible.
  - 1. Splices should be cut at a 22.5 degree angle. Miter external corners and cope internal corners.
  - 2. Where blind nailing is not possible, drill pilot holes at locations best hidden in finished work.
  - 3. Use only finish or casing nails. Set nails for putty stopping in surfaced members

#### **3.3 FIELD FINISHING**

#### **3.4 ADJUSTING**

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

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- C. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- D. Clean, lubricate, and adjust hardware

### 3.5 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.
- B. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

### 3.6 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Owner that ensures that woodwork is without damage or deterioration at time of Substantial Completion.

**END OF SECTION 06 4100**



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**SECTION 06 6400  
FIBER REINFORCED PLASTIC (FRP) PANELING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Fiberglass reinforced plastic (FRP) paneling for wall and ceiling surfaces, including trim accessories as indicated in the Drawings.

**1.2 RELATED SECTIONS:**

- A. Section 06 1000 - Rough Carpentry.
- B. Section 09 2116 - Gypsum Board Assemblies:

**1.3 REFERENCE STANDARDS**

- A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation current edition.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.
- D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- E. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2022.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- G. FDA Food Code - Chapter 6 - Physical Facilities Current Edition.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meetings: Conduct preinstallation meeting to clarify Project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.5 SUBMITTALS**

- A. Refer to Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Technical Data: For each type of product required, including product characteristics, accessories and limitations.
- C. Shop Drawings: Showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

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- D. Samples: Selection and verification samples for finishes, colors and textures. Submit 4 samples of each type of panel, trim and fastener.
- E. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
- F. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.
- G. Manufacturer's Instructions: Manufacturer's Installation Guide for FRP.
- H. Qualifications Statements: For manufacturer and installer.
- I. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.
- J. Warranty: Warranty documents required in this section.

### 1.6 MAINTENANCE MATERIAL

- A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 01 Closeout Submittals Section.
  - 1. Quantity: Furnish quantity of units equal to 10% percent of amount installed.
  - 2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Minimum of 5 years experience manufacturing similar products.
  - 2. Provider of advanced installer training.
- B. Installer Qualifications:
  - 1. At least five years experience in the installation of fiberglass reinforced plastic panels.
  - 2. Experience on at least five projects of similar size, type and complexity as this Project.
  - 3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated.
- C. Surface-Burning Characteristics: Determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction.
  - 1. Flame-Spread Index: 25 (Class A) or less.
  - 2. Smoke-Developed Index: 450 or less.

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D. Meets USDA/FSIS requirements.

### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.
- B. Storage and Handling: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels in a dry indoor location at Project site. Remove any foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

### 1.9 PROJECT CONDITIONS

- A. Ambient Conditions:
  - 1. Do not begin installation until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
  - 2. During installation, and within 48 hours prior to installation, maintain ambient temperature and relative humidity within limits required by type of panel adhesive used and recommendation of panel adhesive manufacturer.

### 1.10 WARRANTY

- A. See Section 01 7836 - Warranty and Bonds for additional warranty requirements.
- B. Warranty Period: 1 year from date of purchase.
- C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace FRP panels that fail within specified warranty period.
  - 1. Failures shall include, but not be limited to substantial defects in material and workmanship, rotting, rusting, corrosion, development of structural surface cracks, or requiring painting or refinishing.
  - 2. Warranty Period: Ten years from date of Substantial Completion.
- D. Special Warranty: Installer's standard form in which installer agrees to repair or replace FRP panels that fail due to poor workmanship or faulty installation within the specified warranty period.
  - 1. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design Product: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

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1. Panolam FRP by Panolam Industries International, Inc., 20 Progress Drive, Shelton, CT 06484. Tel: 877-726-6526, Fax: 203-225-0050. Web: www.panolam.com.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  1. Crane Composites, Inc.; Glasbord Fiberglass Reinforced Plastic (FRP) Panels,
  2. Marlite; 1 Marlite Drive, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.
  3. Fibertech, 4110 Old Greenville Hwy, Central, SC, (864) 646-3000, www.fibertech.net
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

- A. Type W-3: Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D5319.
- B. Product Options:
  1. Class A (I).
  2. Use: Walls as indicated on Drawings.
  3. Color: Classic Collection: White.
  4. Surface Finish: Smooth texture.
  5. Dimensions:
    - a. Nominal Thickness: 0.09 inch.(2.3 mm).
    - b. Width - 4'-0" (1.22m) nominal
    - c. Wall Panel Size: As indicated on drawings.
  6. Surface Protection: Manufacturer's proprietary molecularly-bonded surface protection film for fiberglass reinforced plastic (FRP) panels.

### 2.3 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
  1. Match panel colors.
  2. Length to suit project conditions.
- B. Moldings, Trim, and Caps: 1-piece extruded polypropylene, configured to cover panel edges and corners.

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1. Color: Match Panels
- C. Panel Adhesive: As recommended by panel manufacturer for the required substrates, complying with ASTM C557.
  1. Adhesive shall have a VOC content of 50 g/L or less.
- D. Panel Sealant: Bright white, 2-part urethane sealant, as recommended by FRP panel manufacturer.
  1. VOC Content: 0.0 g/L.

### 2.4 SOURCE QUALITY CONTROL

- A. Obtain fiberglass reinforced panels, moldings and other accessories from a single manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. General: Comply with manufacturer's product data, including product technical bulletins, and installation instructions in product catalogs and product packaging.
- B. Verify that substrates previously installed under other sections are acceptable for product installation in accordance with FRP manufacturer's instructions.
  1. Examine substrate surfaces to determine that corners are plumb and straight, that surfaces are smooth, sound and uniform, that nails or screw fasteners are countersunk, and that joints and cracks are filled flush and smooth with adjoining surfaces.
  2. Do not begin panel installation until substrate surfaces are in satisfactory condition.

### 3.2 PREPARATION

- A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust or other contamination.
- B. Condition panels by unpacking and placing in installation space no less than 24 hours before installation.
- C. Lay out paneling before beginning installation. Locate panel joints to provide equal panel widths at ends of walls and so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

### 3.3 INSTALLATION

- A. General: Comply with panel manufacturer's Installation Guide.
- B. Cut and drill panels, finished face down, with carbide tipped saw blades or drill bits, or cut with snips.
- C. Install panels with manufacturer's recommended gap for panel field and corner joints.
  1. Use fasteners in accordance with manufacturer's instructions to install FRP panels securely to supports.

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2. Pre-drill fastener holes in panels, 1/8 inch (3.2 mm) greater in diameter than fastener.
  3. Install panels in a full spread of adhesive. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
- D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- E. Sealant:
1. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
  2. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths.
- F. Tolerances:
1. Width:  $\pm 1/8''$  ( $\pm 3.2$  mm)
  2. Length:  $\pm 1/8''$  ( $\pm 3.2$  mm) up to 12' (3.7 m)
  3. Squareness:  $\pm 1/8''$  (3.2 mm) in 48" (1.2 m) of width

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### 3.5 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace any installed products that have been damaged.
- C. Remove excess sealant from panels and moldings. Clean installed panels in accordance with manufacturer's instructions.
- D. Remove and lawfully dispose of construction debris from project site.

### 3.6 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

**END OF SECTION 06 64 00 06 6400**

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**SECTION 06 6410  
FIBER REINFORCED LAMINATE PANELS (FRL)**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Prefinished fiber reinforced laminate panels (FRL) for wall installation.

**1.2 RELATED SECTIONS:**

- A. Section 079200 - Joint Sealants
- B. Section 09 2116 - Gypsum Board Assemblies.
- C. Section 09 6500 - Resilient Flooring, Wall Base and Accessories: Resilient Base.

**1.3 REFERENCE STANDARDS**

- A. National Electrical Manufacturer's Association NEMA: NEMA LD3.13 - Wear Resistance.
- B. ASTM D5319-17 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels
- C.  $\{\rs\#1\}$  - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017

**1.4 SUBMITTALS**

- A. Refer to Section 01 3300 - Submittal Requirements, for Submittal procedures.
- B. Product Data: Submit manufacturer's information describing physical and performance characteristics, patterns, attachment methods, colors and finishes available.
- C. Samples: Submit five (5) samples 3 x 6 inches in size of panel and five (5) pieces of molding illustrating panel and molding color.
- D. Manufacturer's Instructions: Submit installation instructions including preparation, application, termination and cleaning.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer: Minimum of 10 years experience manufacturing similar products.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

**1.7 WARRANTY**

- A. Refer to Section 01 7836 - Warranties and Bonds for additional warranty requirements.
- B. Manufacturer's Warranty: Provide manufacturer's standard warranty against defects in manufacturing.

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### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design Product: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Panolam Industries International, Inc., One Corporate Drive, Suite 725, Shelton, CT 06484.
    - a. Tel: 203-925-1556. Web: www.panolam.com.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. Nevamar's FRL® Fiber Reinforced Laminate.
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

#### 2.2 FIBER REINFORCED LAMINATES

- A. Color and Finish: Provide color, texture and finish as shown on Drawings and Material Schedules.

#### 2.3 MATERIALS

- A. Thermofused melamine overlay, decorative paper and Fire Rated phenolic paper with fiber reinforcing inner layers.
- B. Thickness: 0.075 inches.
- C. Size as required for installation.
- D. IMO Certified for marine use.
- E. Wear Resistance (Cycles) NEMA 3.13: 3500 typical.
- F. Flexural Strength ASTM D790: 20,148 psi typical.
- G. Surface Burning Characteristics: US Standard UL-723/ASTM E84 Class A.

#### 2.4 ACCESSORIES

- A. Anodized Aluminum Molding Profiles: Outside corners flat, outside corners round, division bars, inside corners, standard end caps.
- B. Joint Caulking: Color Sil by Color Rite or equal approved by panel manufacturer; 100 percent silicone based colored caulking.
- C. Adhesive and mechanical anchors shall be as recommended by the panel manufacturer for the appropriate substrate.

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**PART 3 INSTALLATION**

**3.1 EXAMINATION**

- A. A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Verify all work on substrate is completed including framing, blocking and backing for accessories and gypsum board.
- B. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation.
- C. Beginning of installation means acceptance of substrate and preparation work by other trades.

**3.3 INSTALLATION**

- A. Install panels as shown on drawings and in strict accordance with the manufacturer's instructions and approved submittals.
- B. Install panels in vertical position. Maintain 4 foot module throughout. Cut panels where required to conform to substrate shall match 4 foot module.
- C. Install panels full height without horizontal joints.
- D. Place FRL panels in place leaving approximately 1/8 inch between panels.
- E. Mount panels to substrate with manufacturer's recommended adhesive spread to an even constant thickness.
- F. Provide manufacturer's recommend trim at vertical joints, interior and exterior corners, panel terminations at sides, bottom and top and cutouts as shown on drawings.
- G. Where no trim is used, seal panel joints and top, side and bottom edges with colored sealant to match panel color. Wipe smooth and remove excess sealant from panel face.
- H. Apply pressure to entire panel face with laminate type "J" roller, to remove trapped air and ensure proper adhesion between interior surfaces.

**3.4 ADJUSTING AND CLEANING**

- A. Replace installations out of plumb and not aligned with adjacent panels and construction.
- B. Clean panel face to remove soiling, stains, dust, and dirt using clean rags, and cleaning agents as instructed by manufacturer.
- C. Leave installation clean, free of residue and debris resulting from work of this Section.

**END OF SECTION 06 6410**

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**SECTION 07 2100  
BUILDING INSULATION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Board insulation at over roof deck, over roof sheathing, and exterior wall behind \_\_\_\_\_ wall finish.
- B. Mineral fiber blanket insulation in exterior wall construction.
- C. Mineral fiber board insulation.
- D. Mineral Fiber Board Fire-Safing insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Exterior Metal stud walls.
- B. Section 07 5419 - Polyvinyl-Chloride Roofing: Insulation specified as part of roofing system. Installation requirements for board insulation over low slope roof deck.
- C. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

**1.3 DEFINITIONS**

- A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
  - 1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
  - 2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
  - 3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

**1.4 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2023.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

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- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2023.
- G. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board 2017.
- H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2023a.
- I. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings 2019 (Reapproved 2022).
- J. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2023).
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2021a.
- N. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products 2022 (Corrigendum 2021).
- O. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures 2006.
- P. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.
- Q. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.
- R. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

### Building Insulation - 07 2100

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### 1.6 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

## PART 2 PRODUCTS

### 2.1 APPLICATIONS

- A. Insulation Over Metal Stud Framed Walls, Continuous: Black Mat Faced Mineral fiber board.
- B. Insulation in Metal Framed Walls: Mineral Fiber Blanket insulation with no vapor retarder.
- C. Acoustical Insulation in Metal Framed Walls: Mineral Fiber Blanket insulation with no vapor retarder.

### 2.2 FOAM BOARD INSULATION MATERIALS

- A. Type BI-1 - Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
  - 1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
      - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F.
  - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 4. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
  - 5. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
  - 6. Board Size: 48 inch by 96 inch.
  - 7. Board Thickness: 2.0 inch.
  - 8. Board Edges: Square.
  - 9. Products:
    - a. DuPont de Nemours, Inc; Thermax Brand \_\_\_\_ : [building.dupont.com/#sle](http://building.dupont.com/#sle).

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b. Or Approved Equal.

### 2.3 MINERAL FIBER BOARD INSULATION MATERIALS

- A. Type BI-2 - Mineral Fiber Board Thermal Insulation: Semi-rigid stone wool insulation that is noncombustible; Type IVB in accordance with ASTM C612.
1. Applications: Insulation for exterior rainscreen system with open joint cladding for thermal control and fire protection as indicated on drawings.
  2. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
  3. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
  4. Facing: Black mat facing.
  5. Board Thickness: 2 inches.
    - a. Board Size: 16 by 48 inches.
  6. Board Edges: Square.
  7. Complies with NFPA 285 requirements for wall assemblies.
  8. Thermal Resistance: R-value of 4.3 per 1 inch at 75 degrees F, minimum, when tested in accordance with ASTM C518 or ASTM C177.
  9. Noise Reduction Coefficient (NRC): Not less than 1.0 for 2 inches (51 mm) thick when measured and calculated in accordance with ASTM C423.
  10. Monolithic Density (2 inches or Less Thickness): 4.3 pcf, nominal.
  11. Moisture Resistance: Absorption of less than 0.65 percent by volume.
  12. Water Vapor Permeance: 43 perm, maximum, at 1 inch thick when tested in accordance with ASTM E96/E96M, desiccant method.
  13. Metallic Corrosion Resistance: Noncorrosive/passed, when tested in accordance with ASTM C665 for steel, and ASTM C795 for stress corrosion cracking tendency of austenitic stainless steel.
  14. Melting Point: 2,150 degrees F, minimum.
  15. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.
  16. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 6000 - Product Requirements for additional information.
  17. Products:
    - a. ROCKWOOL; CAVITYROCK BLACK: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).

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- b. Or Approved Equal.

### 2.4 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Type BI-3 - Mineral Fiber Blanket Thermal Insulation: Semi-rigid stone wool insulation that is noncombustible; Type 1 in accordance with ASTM C665.
  - 1. Applications: Insulation for steel stud exterior walls for thermal control and fire protection as indicated on drawings.
  - 2. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
  - 3. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
  - 4. Facing: Unfaced.
  - 5. Steel Studs: See Section 05 4000.
    - a. Blanket Overall Size: 2-1/2 inches thick by 16-1/4 inches wide by 48 inches long, nominal.
    - b. Thermal Resistance: R-value of 10 at 75 degrees F, minimum, when tested in accordance with ASTM C518.
  - 6. Board Edges: Square.
  - 7. Density: Greater than 2 pcf, nominal.
  - 8. Moisture Resistance: Absorption of less than 0.03 percent by weight.
  - 9. Metallic Corrosion Resistance: Noncorrosive/passed, when tested in accordance with ASTM C665 for steel, and ASTM C795 for stress corrosion cracking tendency of austenitic stainless steel.
  - 10. Melting Point: 2,150 degrees F, minimum.
  - 11. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.
  - 12. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 6000 - Product Requirements for additional information.
  - 13. Low-Emitting VOC Material Certification: Greenguard Gold certified and listed in UL (GGG).
  - 14. Products:
    - a. ROCKWOOL; COMFORTBATT: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - b. Or Approved Equal
- B. Type BI-4 - Mineral Fiber Blanket Acoustical Insulation: Lightweight stone wool insulation that is noncombustible; Type 1 in accordance with ASTM C665.

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1. Applications: Insulation for steel stud interior walls for sound control and fire protection as indicated on drawings.
2. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
3. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
4. Facing: Unfaced.
5. Board Size: 24 by 48 inches.
6. Noise Reduction Coefficient (NRC): Not less than 0.70 for 1 inch (25.4 mm) thick when measured and calculated in accordance with ASTM C423.
7. Board Edges: Square.
8. Density: Greater than 2.2 pcf, nominal.
9. Moisture Resistance: Absorption of less than 0.03 percent by volume.
10. Metallic Corrosion Resistance: Noncorrosive/passed, when tested in accordance with ASTM C665 for steel, and ASTM C795 for stress corrosion cracking tendency of austenitic stainless steel.
11. Melting Point: 2,150 degrees F, minimum.
12. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.
13. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 6000 - Product Requirements for additional information.
14. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 6000 - Product Requirements for additional information.
15. Low-Emitting VOC Material Certification: Greenguard Gold certified and listed in UL (GGG).
16. Products:
  - a. ROCKWOOL; AFB evo (Acoustical Fire Batt-Formaldehyde Free) Insulation:  
[www.rockwool.com/#sle](http://www.rockwool.com/#sle).
  - b. Or Approved Equal
- C. Type BI-5 - Mineral Fiber Enclosure for Recessed Ceiling Fixtures: Insulated box enclosure with foil facing on exterior side for placement over recessed ceiling light fixture; flame spread index of 25 or less, and smoke development index of 450 or less when tested in accordance with ASTM E84.
  1. Light Fixture Size: As indicated on drawings.
  2. Insulation Thickness: 1-1/4 inch, nominal.

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3. Thermal Resistance: R-value of 4.2 per inch, minimum, at 75 degrees F, minimum, when tested according to ASTM C518.
  4. Provide enclosure with documented noise reduction coefficient (NRC) in accordance with ASTM C423 of at least 1.00 at 2 inches thick.
  5. Provide enclosure with documented ceiling attenuation class (CAC) in accordance with ASTM E1414/E1414M.
  6. Products:
    - a. Specialty Products & Insulation (SPI); SafeLite: [www.spi-co.com/#sle](http://www.spi-co.com/#sle).
    - b. Or Approved Equal.
- D. Type B1-6 - Mineral Fiber Board Fire-Safing Insulation: Semi-rigid stone wool insulation that is noncombustible, firestopping component; Type IVA in accordance with ASTM C612.
1. Applications: Fire-safing insulation for filling perimeter gaps between concrete floor slabs and exterior wall systems, between firewalls and ceiling slabs, and around conduit pipes and duct openings through walls and floor slabs, and firestopping control as indicated on drawings.
  2. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
  3. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
  4. Smoke Barrier Sealant: Provide firestopping sealant as listed in applicable fire test assembly; see Section 07 8400.
  5. Facing: Unfaced.
  6. Board Thickness: 2 inches.
  7. Board Size: 24 by 48 inches.
  8. Board Edges: Square.
  9. Noise Reduction Coefficient (NRC): Not less than 1.00 for 2 inches (51 mm) thick when measured and calculated in accordance with ASTM C423.
  10. Density: 4.5 pcf, nominal.
  11. Moisture Resistance: Absorption of less than 0.04 percent by volume.
  12. Metallic Corrosion Resistance: Noncorrosive/passed, when tested in accordance with ASTM C665 for steel, and ASTM C795 for stress corrosion cracking tendency of austenitic stainless steel.
  13. Melting Point: 2,150 degrees F, minimum.
  14. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.

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15. Environmental Product Declaration (EPD): Material included on UL-certified EPD in accordance with EN 15804 and ISO 14025; see 01 6000 - Product Requirements for additional information.

16. Products:

a. ROCKWOOL; ROXUL SAFE: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).

b. Or Approved Equal.

E. Substitutions: See Section 01 2500 - Substitution Procedures.

### 2.5 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

3. Temperature Resistance: Range of minus 40 to 212 degrees F.

B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate.

C. Continuous Insulation (CI) Support Systems: Composite framing support (CFS) system consisting of insulated fiberglass reinforced plastic (FRP) girts that support CI and provide cladding attachment support integrated with metal wall panels, UHPC panels, or phenolic panels exterior wall cladding.

1. Substrate: Attach CFS system components to exterior sheathing over metal stud framing.

2. Depth of Girts: As required for thickness of insulation.

3. Length: \_\_\_ inches for clips, and 96 inches for girts.

4. Spacing of Girts: 16 inches on center, vertically.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### 3.2 GENERAL:

A. Install insulation in accordance with manufacturer's written recommendations.

B. Install insulation to maintain continuity of thermal protection to building elements and spaces.

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- C. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

### 3.3 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards horizontally on walls.
  - 1. Place boards to maximize adhesive contact.
  - 2. Install in running bond pattern.
  - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.
- D. Tape insulation board joints.

### 3.4 BOARD INSTALLATION USING COMPOSITE FRAMING SUPPORT (CFS) SYSTEM

- A. Install CFS system in accordance with manufacturer's installation instructions.
- B. Install CFS system in compliance with system orientation, sizes, and locations as indicated on drawings.
- C. Install CFS system to fill-in exterior wall spaces without gaps or voids, and do not compress insulation boards.
- D. Trim insulation neatly to fit spaces, and insulate miscellaneous gaps and voids with approved expandable foam sealant.

### 3.5 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Installation of board insulation over low slope roof deck, see Section 07 54 19.
- B. Board Installation Over Roof Deck, General:
  - 1. See applicable roofing specification section for specific board installation requirements.
  - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
  - 3. Do not apply more insulation than can be covered with roofing on the same day.

### 3.6 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

- A. Installation of board insulation over steep slope roof structure or roof sheathing, see Section 07 41 13.

### 3.7 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

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- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Retain insulation batts in place with spindle fasteners at 12 inches on center.
- F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

### 3.8 ACOUSTIC INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Comply with manufacturer's instructions for particular conditions of installation in each case.
- C. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- D. Batts may be friction fit in place until the interior finish is applied. Install batts to fill entire Stud cavity. If stud cavity is less than 96" in height, cut lengths to friction fit against floor and ceiling tracks, walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities.
- E. Where walls are not finished on both sides or insulation does not fill the cavity depth, supplementary support must be provided to hold product in place.
- F. Where insulation must extend higher than 8 feet, temporary support can be provided to hold product in place until the finish material is applied.
- G. Acoustic Sealant: Refer to Section 07 9200 - Joint Sealants.

### 3.9 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.

### 3.10 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION 07 2100**

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**SECTION 07 2400  
EXTERIOR INSULATION AND FINISH SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Composite wall cladding of rigid insulation and reinforced finish coating over cementitious base coat, Class PM.
- B. Drainage and water-resistive barriers behind insulation board.
- C. Textured Acrylic Finishes for Exterior Soffits.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Sheathing on metal studs.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Perimeter flashings.
- C. Section 07 9200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

**1.3 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- C. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2023.
- F. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster 2023.
- G. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage 2013 (Reapproved 2019).
- H. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive 2022.
- I. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity 2015 (Reapproved 2020).
- J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

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- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- M. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies 2018.
- N. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS) 2022.
- O. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013 (Reapproved 2021).
- P. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials 2021.
- Q. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems 2009, with Editorial Revision (2022).
- R. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies 2015, with Editorial Revision (2022).
- S. ISO 9001 - Quality Management Systems — Requirements 2015.
- T. NFPA 259 - Standard Test Method for Potential Heat of Building Materials 2023, with Errata.
- U. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source 2022.
- V. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.
- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.
- F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.
- G. Installer's qualification statement.

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### 1.5 QUALITY ASSURANCE

- A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.
- B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
  - 1. Member in good standing of EIMA (EIFS Industry Members Association).
  - 2. Manufacturer of EIFS products for not less than 5 years.
  - 3. Manufacturing facilities ISO 9001 certified.
- C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.
- D. Installer Qualifications: Company specializing in the type of work specified and with at least five years of documented experience.

### 1.6 MOCK-UPS

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Construct mock-up of typical EIFS application on specified substrate, size as indicated on drawings, and including flashings, joints, and edge conditions.
- C. Locate mock-up as indicated on drawings.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- C. Storage: Store materials as directed by manufacturer's written instructions.
  - 1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
  - 2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
  - 3. Protect insulation materials from exposure to sunlight.

### 1.8 FIELD CONDITIONS

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

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- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.
- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

### 1.9 WARRANTY

- A. See Section 01 7800 - Closeout Procedures and Submittals for additional warranty requirements.
- B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.
- C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design:
  - 1. Dryvit Systems, Inc; Dryvit Outsulation Plus MD EIFS, Class PB with Moisture Drainage: [www.dryvit.com/#sle](http://www.dryvit.com/#sle).
  - 2. Dryvit Systems, Inc; Dryvit Textured Acrylic Finishes (TAFS Option 2) for Exterior Soffits
- B. Other Acceptable Exterior Insulation and Finish Systems Manufacturers:
  - 1. Sto Corp: [www.stocorp.com/#sle](http://www.stocorp.com/#sle).
- C. Or Equal.

### 2.2 EXTERIOR INSULATION AND FINISH SYSTEM

- A. Application: As indicated on Drawings.
- B. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on mechanically-fastened insulation board over sheet-type drainage layer and water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.
- C. Allowable Wind Loading: At least \_\_\_\_\_ psf, positive and negative, determined in accordance with ICC-ES AC219 or ICC-ES AC235 using factor of safety of 3.0.
- D. Fire Characteristics:
  - 1. Flammability: Pass, when tested in accordance with NFPA 285.
  - 2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
  - 3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability

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(above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

- E. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
- F. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.
- G. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.
- H. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.
- I. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.
- J. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.
- K. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.
- L. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.
- M. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:
  - 1. Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.

### 2.3 MATERIALS - OUTSULATION

- A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
  - 1. Texture: Dryvit Systems, Inc, Standard Textures, with Dirt Pickup Resistance; Freestyle DPR: [www.dryvit.com/#sle](http://www.dryvit.com/#sle).
- B. Base Coat: Acrylic- or polymer-modified, fiber reinforced Portland cement coating, Class PM.
  - 1. Portland Cement: ASTM C150/C150M, Type I or II.
  - 2. Base Coat Thickness: 1/4 inch, minimum.

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- C. Reinforcing Mesh: Balanced, alkali-resistant, symmetrical, interlaced open-weave glass-fiber fabric treated for compatibility with other system materials, made from continuous multi-end strands with tensile strength of not less than 145 lb/inch and 150 lb/inch in warp and fill directions complying with ASTM D5035, ASTM D578, ASTM E2098. Designed for Drainable EIFS.
- D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
  - 1. Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
  - 2. Board Size: 24 by 48 inches.
  - 3. Board Size Tolerance: Plus/minus 1/16 inch from square and dimension.
  - 4. Board Thickness: 1-1/2 inches.
  - 5. Board Edges: Square.
  - 6. Type and Thermal Resistance, R-value (RSI-value): Type XI, 3.1 (0.55) per 1 inch thickness at 75 degrees F mean temperature using ASTM C177 test method.
  - 7. Type and Board Density: Type XI, 0.70 pcf (12 kg/cu m), minimum.
  - 8. Type and Compressive Resistance: Type XI, 5 psi (35 kPa), minimum.
  - 9. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.
- E. Drainage Layer or Spacers: Furnished or approved by EIFS manufacturer; capable of achieving specified drainage rate; not required to be water-resistive, air retarder, or vapor retarder.

### 2.4 TEXTURED ACRYLIC FINISHES

- A. Application: Horizontal soffits as indicated on Drawings.
- B. Materials - TAFS
  - 1. Portland Cement: Shall be Type I, I-II or II, meeting ASTM C150, white or gray in color, fresh and free of lumps.
  - 2. Water: Shall be clean and free of foreign matter.
- C. Components:
  - 1. Base Coat: Shall be compatible with the sheathing and reinforcing mesh(es).
    - a. Cementitious: A liquid polymer based material, which is field mixed with Portland Cement.
      - 1) Shall be Genesis® or Primus®.
    - b. Non-cementitious: A factory mixed, fully formulated, water based product.

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- 1) Shall be NCB™.
- c. Ready mixed: A dry blend cementitious, co-polymer based product, field mixed with water.
  - 1) Shall be Primus® DM™, Genesis DM™, Rapidry DM 50-75, or Rapidry DM 35-50.
2. Reinforcing Mesh: Shall be a balanced open weave, glass fiber fabric treated for compatibility with other System materials.
  - a. Shall be Dryvit Standard Mesh weighing 4.3 oz/yd<sup>2</sup> (146 g/m<sup>2</sup>).
    - 1) It shall be colored blue for product identification bearing the Dryvit logo.
- D. Finishes: Shall be the type, color, and texture as selected by the owner/architect and shall be one or more of the following:
  1. Specialty Finishes: Factory mixed, water based acrylic:
    - a. Finesse™: A smooth 100% acrylic-based dirt pickup resistance finish.
  2. Primers (when specified):
    - a. Color Prime™: Pigmented acrylic based primer used to improve adhesion and uniformity of finish color.
    - b. Primer with Sand: Pigmented acrylic based primer with a slight sand texture to improve adhesion and uniformity of finish color and application of trowel applied finishes.

### 2.5 ACCESSORIES

- A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.
- B. Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.
- C. Metal Flashings: See Section 07 6200.
  1. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:
    - a. SMACNA – Architectural Sheet Metal Manual.
    - b. Approved submittals.
    - c. Contract Documents.
  2. Fabrication Procedures: Fabricate continuous flashings in sections 96 in (2400 mm) long minimum, but not exceeding 144 in. Provide splice plates at joints of formed, smooth metal flashing.
  3. Flashing Joinery: Fabricate interior and exterior corners, intersections, and complex flashing conditions in shop, with properly folded, constructed and continuous soldered joints.

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- D. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.
- E. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.
- F. Exterior Soffit Vents: One piece, perforated, ASTM A653/A653M galvanized steel with G90 coating, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.
- B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

#### **3.2 PREPARATION**

- A. Install self-furring metal lath over solid substrates that are deemed unacceptable to receive adhesively applied insulation. Install in accordance with ASTM C1063, except for butt-lapping instead of overlapping.
  - 1. Attach to concrete and concrete masonry using corrosion-resistant power or powder actuated fasteners or hardened concrete stub nails not less than 3/4 inch long and with heads not less than 3/8 inch wide. Ensure that fasteners are securely attached to substrate and spaced at maximum 16 inches on center horizontally and 7 inches vertically.
- B. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

#### **3.3 INSTALLATION - GENERAL**

- A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
  - 1. Where different requirements appear in either document, comply with the most stringent.
  - 2. Neither of these documents supercedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

#### **3.4 INSTALLATION - INSULATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.
- C. On wall surfaces, install boards horizontally.

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- D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.
- E. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.
- F. Rasp irregularities off surface of installed insulation board.
- G. Mechanical Fastening: Space fasteners as recommended by EIFS manufacturer.
- H. Adhesive Attachment: Use method recommended by EIFS manufacturer.

### 3.5 INSTALLATION - CLASS PB FINISH

- A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
  - 1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
  - 2. Allow base coat to dry a minimum of 24 hours before next coating application.
- B. At locations indicated, install second layer of reinforcing mesh embedded in second coat of base coating, tightly butting ends and edges of mesh.
- C. Install expansion joints at floor lines as recommended by EIFS manufacturer.
- D. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.
- E. Finish Coat Thickness: As recommended by manufacturer.
- F. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

### 3.6 CLEANING

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

### 3.7 PROTECTION

- A. Protect completed work from damage and soiling by subsequent work.

**END OF SECTION 07 2400**

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**SECTION 07 2726  
FLUID-APPLIED MEMBRANE AIR BARRIERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Window and door flashing, air and water-resistive barrier membrane system, and accessory materials for application to exterior building envelope substrates as indicated on the drawings.

**1.2 RELATED REQUIREMENTS**

A. Section 07 2100 - Building Insulation

B. Section 07 2400 - Exterior Insulation and Finish Systems: Water-resistive barrier under exterior insulation.

C. Section 07 4619 - Corrugated Metal Panels

D. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

E. Section 07 9200 - Joint Sealants: Sealing building expansion joints.

F. Section 09 2116 - Gypsum Board Assemblies: Exterior sheathing.

**1.3 REFERENCE STANDARDS**

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions 2016.

C. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants 2018 (Reapproved 2022).

D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

E. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives 1998 (Reapproved 2021).

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

G. ASTM D2369 - Standard Test Method for Volatile Content of Coatings 2020.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.

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- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- J. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- K. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies 2023a.
- L. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene before the start of installation of air and water-resistive barrier system.
  - 1. Require attendance of parties directly affecting work of this Section, including the Owner's Representative, Contractor, Architect, installing subcontractor, membrane system manufacturer's representative, roofing and foundation waterproofing subcontractors, and all subcontractors who have materials penetrating membrane system or finishes covering membrane system.
  - 2. Contractor shall notify Architect at least seven days prior to time for conference.
  - 3. Contractor shall record minutes of meeting and distribute to attending parties.
  - 4. Review the following:
    - a. Surface preparation.
    - b. Substrate condition and pretreatment.
    - c. Minimum curing period.
    - d. Special details and sheet flashing.
    - e. Sequence of construction, responsibilities, and schedule for subsequent operations.
    - f. Installation procedures.
    - g. Inspection procedures.
    - h. Protection and repair procedures.
    - i. Review and approval of all glazing applications.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.
- B. Performance description:

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1. The building envelope shall be constructed with a continuous, air and water-resistive barrier to control air leakage, avoid condensation in the interior wall assembly and prevent water intrusion.
2. Joints, penetrations and paths of water and air infiltration shall be made watertight and airtight.
3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of systems due to thermal and moisture variations.

### 1.6 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product data:
  1. Submit manufacturer's product data and installation guidelines, including membrane and accessory material types, technical and test data, composition, descriptions and properties, installation instructions and substrate preparation requirements.
- C. Certificates:
  1. Certificates by manufacturer stating that manufacturer and installer meet qualifications as herein specified.
- D. VOC Certification: Submit certification that products furnished comply with regulations controlling use of volatile organic compounds (VOC).

### 1.7 QUALITY ASSURANCE

- A. Applicable standards, as referenced herein: ASTM International (ASTM).
- B. Manufacturer's qualifications: Air and water-resistive barrier systems shall be manufactured and marketed by a company with a minimum of five (5) years' experience in the production and sales of air and water-resistive barrier system. Manufacturers proposed for use, but not named in these specifications, shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- C. Installer's qualifications: The installer shall demonstrate qualifications to perform the work of this section by submitting the following:
  1. Verification that the installer completed SWR Institute's Validated Air Barrier Training and is approved to perform work as herein specified by air and water-resistive barrier system manufacturer.
  2. List of at least three (3) projects completed of similar scope and complexity to this project carried out by the firm and site supervisor.
- D. Inspection and testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover installed products or assemblies until they have been inspected, tested and approved.

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- E. Sole source: Obtain materials within the scope of this specification from a single manufacturer.
- F. Regulations: Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOC).
- G. Mock-up:
  - 1. Prior to installation of the weather and air barrier system a field-constructed mock-up shall be applied to verify details and tie-ins, to demonstrate the required installation.
    - a. Construct a typical exterior wall section, 8 feet long and 8 feet wide, incorporating back-up wall, cladding, window, door frame, sill, penetrations, insulation, flashing and any other critical junction.
    - b. Allow 72 hours for inspection and testing of mock-up before proceeding with weather and air barrier work.
    - c. Coordinate construction of mockups to permit inspection by Architect and Owner's Representative of air barrier before beginning installation.
    - d. Approved, undamaged mock-up must remain as part of the work.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Protect air and water-resistive barrier components from freezing and extreme heat.
- C. Sequence deliveries to avoid delays, and to minimize on-site storage.

### 1.9 FIELD CONDITIONS

- A. Environmental limitations:
  - 1. Comply with manufacturer's written instructions for substrate temperature and moisture content and other conditions affecting performance requirements.
- B. Weather conditions:
  - 1. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.
- C. Proceed with installation only when the substrate construction and preparation work are complete and in condition to receive the membrane system.
- D. Do not apply to frozen substrate. Allow adequate time for substrate to thaw, if freezing conditions exist before application.
- E. Ultra-violet Exposure:



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1. Do not expose air barrier materials to sunlight and weather longer than as recommended by the material manufacturer.

### 1.10 WARRANTY

#### A. Manufacturer's warranty requirements:

1. Submit manufacturer's 5 year limited warranty stating:
  - a. The products have been tested in accordance with national standards for air and water-resistive barriers and passed those tests with effectiveness and durability indicating their suitability for performance as an air and water-resistive barrier system when properly applied.
  - b. The products shall be free from defects in material for a period of five years after the substantial completion of the material application.
  - c. That the products will not disintegrate and will maintain their integrity over the life of the warranty.

#### B. Warranty period: Five (5) years from Date of Substantial Completion.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

#### A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

1. Product: PROSOCO R-Guard Spray Wrap MVP, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.

#### B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. DuPont de Nemours, Inc.; Tyvek Fluid Applied WB+.
2. or Approved Equal.

#### C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 MATERIALS

#### A. Fluid applied air and water-resistive barrier that stops air and water leakage in cavity wall, masonry veneer construction, and most other building wall assemblies.

1. Basis of Design Product: PROSOCO R-Guard Cat 5, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.

#### B. Subject to compliance with the following physical and performance requirements:

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1. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing.
  2. ABAA: Air Barrier Association of America Acceptance Criteria for Liquid Applied Membranes.
  3. Comply with national, state and district AIM VOC regulations and less than 30 grams per Liter.
  4. Water vapor transmission: 25 perms when tested in accordance with ASTM E96 (Wet Cup).
  5. Tensile bond: Minimum 15 psi or exceeds strength of substrate when tested in accordance with ASTM C297.
  6. Surface Burning Characteristics: Class A Building Material, when tested in accordance with ASTM E84. Flame Spread: Equal or less than 25, Smoke Developed: Equal or less than 450.
  7. Total solids: 63 to 68- percent by volume, ASTM D2369.
  8. Fluid applied air and water-resistive barrier that combines silicone and polyurethane properties. Single component, Silyl-Terminated-Polymer (STP) that is roller applied to produce a highly durable, seamless, elastomeric weatherproofing membrane on exterior sheathing, CMU back-up walls, and pre-cast concrete.
- C. Subject to compliance with the following physical and performance requirements:
1. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water Resistive Barriers Over Exterior Sheathing.
  2. ABAA: Air Barrier Association of America Acceptance Criteria for Liquid Applied Membranes.
  3. Comply with national, state and district AIM VOC regulations and less than 30 grams per Liter.
  4. Air Leakage of Air Barrier Assemblies: Less than or equal to 0.04 cfm per square foot at 1.57 psf (less than or equal to 0.2 liters s·sq.m. at 75 Pa) when tested in accordance with ASTM E2357.
  5. Air Permeance: Less than or equal to 0.004 cfm per square foot (Less than or equal to 0.02 L/s/sq m) when tested in accordance with ASTM E2178.
  6. Water vapor transmission: 18 perms when tested in accordance with ASTM E96 (Wet Cup).
  7. Total solids: 99 percent.

### 2.3 FLUID-APPLIED AIR AND WATER-RESISTIVE VAPOR BARRIER

- A. Product: PROSOCO R-Guard VB, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, [www.prosoco.com](http://www.prosoco.com).
- B. Subject to compliance with the following physical and performance requirements:
1. Comply with national, state and district AIM VOC: less than 50 grams per Liter
  2. Air Leakage of Air Barrier Assemblies: Less than or equal to 0.04 cfm per square foot at 1.57 psf (less than or equal to 0.2 liters s·sq.m. at 75 Pa) when tested in accordance with ASTM E2357.

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3. Air permeance: Less than or equal to 0.004 cfm per square foot (Less than or equal to 0.02 L/s/sq m) when tested in accordance with ASTM E2178.
4. Water vapor transmission: 0.063 perms when tested in accordance with ASTM E96 (Dry Cup).
5. Surface Burning Characteristics: Class A Building Material, when tested in accordance with ASTM E84. Flame Spread: Equal or less than 25, Smoke Developed: Equal or less than 450.
6. Water resistance: No water infiltration after exposure to 55 cm head of water for 5 (five) hours when tested in accordance with ICC-ES AC 212 AATCC 127.
7. Fastener sealability: No water infiltration when tested in accordance with ASTM D1970.
8. Total solids: 62.5 percent.

### 2.4 WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES

- A. Primer to seal the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of liquid applied fiber-reinforced fill coat and seam treatment for through-wall components.
  1. Product: PROSOCO R-Guard PorousPrep, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, [www.prosoco.com](http://www.prosoco.com).
- B. Subject to compliance with the following physical and performance requirements:
  1. Breathable liquid primer.
  2. Comply with national, state and district AIM VOC regulations and be 100 g/L or less.
  3. Total solids: 16 percent.

### 2.5 LIQUID APPLIED FILL COAT AND SEAM FILLER

- A. High modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. The single-component, Silyl-Terminated-Polymer (STP) prepares open joints, seams and cracks before installing primary water and air barrier system to prevent the movement of water and air through building envelopes.
  1. Product: PROSOCO R-Guard Joint & Seam Filler, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, [www.prosoco.com](http://www.prosoco.com).
- B. Subject to compliance with the following physical and performance requirements:
  1. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
  2. Water vapor transmission: Minimum 19 perms at 20 mils when tested in accordance with ASTM E96.
  3. Tensile strength: 70 psi when tested in accordance with ASTM D412.
  4. Elongation at break: Greater than 180 percent when tested in accordance with ASTM D412.

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5. Peel strength: Greater than 25 pli when tested in accordance with ASTM D1781.
6. Total solids: 99 percent.

### 2.6 FLASHING

- A. Product: PROSOCO R-Guard FastFlash manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
- B. Subject to compliance with the following physical and performance requirements:
  1. AAMA 714-12 Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal Around Exterior Wall Openings in Buildings.
  2. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing.
  3. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
  4. Water vapor transmission: 21 perms when tested in accordance with ASTM E96.
  5. Tensile strength: Greater than 150 psi when tested in accordance with ASTM D412.
  6. Elongation at break: Greater than 350 percent when tested in accordance with ASTM D412.
  7. Total Solids: 99 percent.

### 2.7 LIQUID-APPLIED FLASHING AND DETAILING MEMBRANE

- A. Gun-grade, spread and tool or roller apply waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. The single component, Silyl-Terminated-Polymer (STP) produces a highly durable, seamless, elastomeric should treat joints, seams, cracks and provide the flashing membrane in rough openings of structural walls and to counter-flash waterproofing and air barrier components.
  1. Product: PROSOCO R-Guard FastFlash manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
- B. Subject to compliance with the following physical and performance requirements:
  1. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
  2. AAMA 714-12 Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal Around Exterior Wall Openings in Buildings.
  3. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing.
  4. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
  5. Water vapor transmission: 21 perms when tested in accordance with ASTM E96.
  6. Tensile strength: Greater than 150 psi when tested in accordance with ASTM D412.

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7. Elongation at break: Greater than 350 percent when tested in accordance with ASTM D412.
8. Total Solids: 99 percent.

### 2.8 INTERIOR SEALANT FOR WINDOWS AND DOORS

- A. High performance, gun-grade waterproofing sealant that combines the silicone and polyurethane properties. Single component, Silyl-Terminated-Polymer (STP) that is that is durable, and stops the movement of moist air through cracks surrounding windows and doors.
  1. Product: PROSOCO R-Guard AirDam, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
- B. Subject to compliance with the following physical and performance requirements:
  1. Comply with national, state and district AIM VOC: less than 30 grams per Liter.
  2. Sealant Validation from Sealant Waterproofing & Restoration Institute (SWRI).
  3. Elongation at break: Greater than 1000% when tested in accordance with ASTM D412.
  4. Peel strength: 25 pli when tested in accordance with ASTM C794
  5. Total solids: 98 percent.
- C. Backer rod: In deep joints, control sealant depth by installing closed cell backer rod. Diameter of the soft-backer rod should be 25 percent greater than the joint width. Do not puncture backer rod.

### 2.9 PREFORMED SILICONE SEALANT EXTRUSION

- A. Manufacturer's standard system consisting of pre-cured low modulus elastomeric extrusion that provides a continuous transition and bridges windows and doors frames at curtain wall, storefront, expansion joints, skylights, roof to air barrier materials. Provide continuous Preformed Silicone Sealant Extrusion System that is flexible, durable, designed for high dynamic and thermal movement which is resistant to ultraviolet exposure and weathering.
  1. Product: PROSOCO R-Guard SureSpan EX, manufactured by PROSOCO Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
- B. Subject to compliance with the following physical and performance requirements:
  1. Elongation: Minimum 400 percent when tested in accordance to ASTM D412.
  2. Joint Movement Capacity: Minimum 200 percent elongation and minimum 75% compression per ASTM C1518 (ASTM C1523).
  3. Tensile Strength: Minimum 700 psi when tested in accordance with ASTM D412.
  4. Tear Strength: Minimum 200 lb/in when tested in accordance with ASTM D624.
  5. Tear Propagation: Pass testing requirements of ASTM C1518 (ASTM C1523). Movement Class shall exceed 200 percent Elongation and a Tear Class of PT (Knotty Tear).

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6. Shore Hardness A: 50 to 65 when tested in accordance with ASTM D2240.
7. UV Resistance: No degradation of material when exposed to UV.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION AND SURFACE PREPARATION

- A. Examine conditions for compliance with system manufacturer's requirements for installation, and other specific conditions affecting performance of air barrier system.
- B. All surfaces must be sound, clean and free of surface oxidation, grease, dirt, excess mortar or other contaminants detrimental to application. Fill or bridge damaged surfaces, voids or gaps larger than one- inch. Fill voids and gaps measuring one- inch or less with liquid applied fill coat and seam filler as necessary to ensure continuity.
  1. Surfaces to receive primary fluid applied air and water barrier must be dry or damp, unless approved by air barrier manufacturer. Surfaces to receive (STP) fluid applied accessories must be dry, damp or wet to the touch. Brush away any standing water present before application. STP products will tolerate rain immediately after application.
  2. Insulated concrete form (ICF) building system surfaces to receive fluid applied primary air and water barrier and accessories must be cleaned to remove surface contaminants that inhibit adhesion prior to application. Preferred method for cleaning oxidation from surface is with water and low-pressure cleaning.
  3. Refer to manufacturer's product data sheets for requirements for condition of and preparation of substrates.
    - a. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
    - b. Remove contaminants such as grease, oil and wax from exposed surfaces.
    - c. Remove dust, dirt, loose stone and debris.
    - d. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.
    - e. Refer to manufacturer's product data sheets and manufacturer's installation guidelines for additional information on preparing structural walls to receive the primary air and water resistive barrier.

#### 3.2 EXTERIOR SHEATHING:

- A. Refer to Section 09 2116 - Gypsum Board Assemblies.
- B. Ensure that sheathing is properly installed with ends, corners and edges properly fastened. Remove and replace damaged sheathing.
- C. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, and spot overdriven fasteners with liquid applied fill coat and seam filler.

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- D. Seal the cut edges of gypsum wall boards exposed in rough openings for windows and doors at corners, as recommended by manufacturer.

### 3.3 MASONRY AND CONCRETE SUBSTRATES:

- A. Masonry head and bed joints should be fully filled and tooled.
- B. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.
- C. Fill cracks, joints and gaps with liquid applied fill coat and seam filler as herein specified.

### 3.4 FIBER REINFORCED FILL COAT AND SEAM FILLER

- A. General: Comply with weather and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
- B. Apply liquid applied fill coat and seam filler for seams, joints, cracks, gaps, primed rough gypsum edges at sheathing, rough openings per manufacturer's written instructions.

### 3.5 LIQUID APPLIED FLASHING AT WINDOWS, DOORS, OPENINGS AND PENETRATIONS

- A. General: Comply with weather and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
- B. Apply liquid flashing membrane over surfaces to seal and waterproof rough openings per manufacturer's written instructions. Spread the wet product to create an opaque, monolithic flashing membrane which surrounds the rough opening and extends 4 to 6 inches over the face of the structural wall. Apply additional coats as needed to achieve void- and pinhole-free surface.

### 3.6 FLUID-APPLIED AIR & WATER-RESISTIVE BARRIER INSTALLATION

- A. General: Comply with weather and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
- B. Apply air and water-resistive barrier to a clean, dry substrate within temperature and weather limitations per manufacturer's written instructions.
  - 1. Apply to recommended thickness.
  - 2. Allow product to cure and dry.
  - 3. Inspect membrane before covering. Repair any punctures or damaged areas by applying additional material.
  - 4. Back roll as necessary to ensure there are no pinholes, voids or gaps in the membrane. Apply fluid applied air and water-resistive barrier per manufacturer's recommendations.
  - 5. Apply additional coats per manufacturer's written instructions.

### 3.7 FLUID-APPLIED FLASHING TRANSITIONS

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- A. General: Comply with weather and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
- B. Apply fiber reinforced fill coat and seam filler and liquid flashing membrane as a liquid flashing membrane to waterproof the transitions in rough opening and between dissimilar materials per manufacturer's written instructions.
  - 1. Fill any voids between the top of the flashing leg and the vertical wall with fiber reinforced fill coat and seam filler.
  - 2. Spread the wet liquid flashing membrane to create a monolithic "cap-flash" flashing membrane per manufacturer's written instructions.
  - 3. Apply additional coats as needed to achieve void- and pinhole-free surface.
  - 4. Allow treated surfaces to skin before installing other wall assembly, waterproofing or air barrier components.
  - 5. Apply preformed silicone sealant extrusion to provide a continuous airtight and water-tight seal between material frame and substrate per manufacturer's written instructions.
    - a. Embed material in bead of liquid flashing membrane per manufacturer's written instructions.

### 3.8 INTERIOR SEALANT FOR WINDOWS AND DOORS INSTALLATION

- A. General: Comply with weather and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
- B. Apply interior waterproofing sealant per manufacturer's written instructions.
  - 1. Install Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Install Backer Rod as necessary per manufacturer's written instructions.
  - 2. Apply interior waterproofing sealant in continuous beads without gaps or air pockets.

### 3.9 PROTECTION

- A. Coordinate scheduling within installation of cover materials to ensure that fluid-applied air barrier system is not exposed to sunlight and weather longer than recommended by the system manufacturer.
- B. Ensure that the top edge of the fluid-applied air barrier and the roofing system is capped and sealed from water intrusion. Ensure the continuity of the fluid-applied air barrier system has been achieved.

**END OF SECTION 07 2726**



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**SECTION 07 4233  
PHENOLIC WALL PANELS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.
  - 1. Wall panels.

**1.2 RELATED SECTIONS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.
- B. Section 07 2100 - Building Insulation; exterior insulation, if required for NFPA 285 compliance.
- C. Section 07 2726 - Fluid Applied Membrane Air Barriers
- D. Section 07 9200 - Joint Sealants: Sealing perimeter and expansion joints in interior stone work.
- E. Section 09 2116 - Gypsum Board Assemblies - Exterior Sheathing.

**1.3 REFERENCES**

- A. ASTM D635 - Standard Test Method for Small Scale Burning.
- B. ASTM D1929 - Standard Test Method for Ignition Temperature.
- C. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
- D. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials;; 2020
- F. ISO 105 A02-93 - Tests for Color Fastness -- Part A02: Grey scale for assessing change in color.
- G. ISO 178 - Determination of Flexural Properties.
- H. ISO 527-3 - Determination of Tensile Properties.
- I. ISO 846 - Evaluation of the Action of Organisms.
- J. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
- K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

**1.4 SYSTEM DESCRIPTION**

**Phenolic Wall Panels - 07 4233**

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- A. Exterior Rainscreen Assembly: Solid phenolic core, fire retardant exterior grade rainscreen wall panels, aluminum substructure, attachment system components, air/vapor barrier membrane, continuous exterior insulation, and all accessories necessary for a complete rear-ventilated, weathertight exterior rainscreen wall system. Furnish fastenings and flashings as required to complete rainscreen system.

### 1.5 PERFORMANCE CRITERIA

- A. Performance Requirements: Provide panels that have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer, without defects, damage or failure.
- B. Structural Design: Design calculations certified by a registered professional engineer licensed in the State of Nevada shall be submitted to verify load carrying capability of panel system using performance requirements and design criteria as indicated. Panel system shall be capable of resisting a minimum positive and negative wind load per ASCE-7 or building code, whichever is greater.
- C. Deflection Limits: Aluminum support structure and exterior phenolic rainscreen panel system shall be designed in accordance with the Manufacturer's recommended maximum deflection when tested under positive and negative design wind gust loads and shall withstand wind gust loads with horizontal deflections no greater than the Manufacturer's allowable span, based on current wind load tables.
- D. Thermal Movements: Exterior solid phenolic rainscreen panel system shall allow for thermal movements from ambient air, surface temperature changes and relative humidity preventing buckling, opening of joints, over-stressing of components, failure of connections and other detrimental effects. Base calculations on surface temperature changes of materials due to both solar heat gain and nighttime sky heat loss.
  - 1. Panel shall remain stable for temperature Change (Range): -112 deg. F, ambient: 356 deg. F, material surfaces.
- E. Support Structure: Provide aluminum support structure capable of the following:
  - 1. Design and install aluminum support structure to accommodate expected construction tolerances and misalignment, deflection of building structural components, and openings in the building enclosure as designed.
- F. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly may be required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous insulation and exterior cladding are components that are required to be to be evaluated as part of this specific assembly test. The basis of design product listed herein is a component of the design test assembly selected by the Architect.

### 1.6 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements , for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.

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2. Storage and handling requirements and recommendations.
  3. Installation methods.
- C. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.
  - D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.
  - E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.
  - F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please note that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.
  - G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field panel edges.
  - H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.
  1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacture or representative and have a minimum of five (5) years of experience in performing work of similar type and scope.
- C. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- D. Pre-installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

### 1.8 MOCK-UP

- A. See Section 01 4000 - Quality Requirements for additional requirements.

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- B. Provide a mock-up for evaluation of the product and application workmanship.
- C. Construct mock-up, include panel system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.
  - 1. Include a window Jamb/Head/Sill condition and an outside corner of each.
- D. Locate as indicated on drawings.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
  - 1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
  - 2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.
- B. Storage:
  - 1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
  - 2. Store products in manufacturer's unopened packaging until ready for installation.
  - 3. Stack panels using protective dividers to avoid damage to decorative surface.
  - 4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
  - 5. Do not store sheets, or fabricated panels vertically.
- C. Handling:
  - 1. Remove protective film within 24 hours of the panels being removed from the pallet.
  - 2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
  - 3. Remove all labels and stickers immediately after installation.

### 1.10 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication

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schedule with construction progress to avoid construction delays.

### 1.11 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds for additional warranty requirements.
- B. Warranty: At project closeout, provide manufacturer's limited ten year warranty covering defects in materials. Warranty only available when material installed by an installation contractor trained and approved by the manufacturer's representative.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

- 1. Manufacturer:

- a. FunderMax GmbH / FunderMax North America, 9401-P Southern Pine Blvd, Charlotte NC 28273.

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

- 1. Trespa North America, Ltd.; Toll Free: Tel: (800) 4-TRESPA. Tel: (858) 679-2090. Fax: (858) 679-9568. Email: info.northamerica@trespa.com. Web: www.trespa.com/na.
- 2. ABET, Inc.: Tel 800-228-2238; www.us.abetlaminati.com
- 3. Or Approved Equal

- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 WALL PANELS

- A. Type RS-2 :Basis of Design: Provide "Max Compact Exterior F-Quality" panels.
- B. Material: Fire-retardant solid phenolic panels with standard brown core comprised of kraft paper harvested from FSC certified forests and thermosetting resins. Dry Formed (DF) or Natural Fiber Core (NFC) products will not be accepted.
  - 1. Rainscreen Panel Surface: NT.
  - 2. Modulus of Elasticity: 1,300,000-psi minimum.
  - 3. Weight: 8mm 2.4 lbs./SF; 10mm, 3 lbs./SF; 12mm, 3.9 lbs./SF
  - 4. Tensile Strength: 11,000-PSI, minimum.

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5. Flexural Strength: 13,000-PSI, minimum.
  6. Surface Impact Resistance: < 8 per EN ISO 178
  7. Scratch Resistance: > 3 /4 N per EN 438:6
  8. Optical Properties: Color Stability Gray Scale > 4 per ISO 4892-2, EN 20105-A02.
  9. Panels shall be hail impact resistant with no breakage per Austrian APBIC Standard, Association of Public Building Insurance Companies. Equivalent test standard 70mm ice ball at a velocity of 30 meters/second (67.10 mph) without breakage, tearing or discoloration.
  10. Panels shall be FSC Certified.
  11. Panels shall have an Environmental Product Declaration (EPD) Report.
  12. Panels shall have a Health Product Declaration (HPD).
  13. Colors: Submit manufacturer's standard colors for verification by Architect and or individual Décor option.
    - a. Color: Refer to Drawings - Material Schedule.
    - b. As selected by Architect from Manufacturer's standard color range and shown on drawings
  14. Finish: As selected by the Architect. Refer to Drawings - Material Schedule.
  15. Panel Core: Brown
  16. Rainscreen Panel Thickness: 10MM.
- C. Panel Tolerance:
1. Thickness: 1/32", maximum.
  2. Length: 1/4", maximum.
  3. Width: 1/4", maximum.
  4. Non-porous homogenous surface and edges which do not require sealing after cutting or drilling.

### 2.3 SUPPORT STRUCTURE

- A. Support systems
1. Concealed Bracket and Rail Components using extruded aluminum profiles, clips, closures and Tees as indicated on the architectural drawings.
    - a. Refer to Section 07 0543 - Rainscreen Attachment Systems.
    - b. Concealed items to be mill finish, exposed items to be painted in exposed areas.
    - c. Brackets to be adjustable for out of plumb conditions.

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### 2.4 SOURCE QUALITY CONTROL:

- A. Panels shall be specifically designed for exterior rainscreen wall applications. Fabricated panels shall comply with all current codes and regulations for the Project. Panels shall have uniform thickness (+0.03”) and flatness (maximum difference of 0.03”) for a 10 foot span.
- B. Flame Spread: Panels to conform to ASTM E84 for Class A fire rating with a Flame spread index of less than 10 and Smoke development index of less than 450.
- C. NFPA-268 Surface Ignition test, pass.
- D. Ignition Temperature: Greater than 650 degrees Fahrenheit above ambient, ASTM D1929
- E. UV stable surface of Acrylic-PUR resin coating of 100 micron thickness or greater with color stability > 4 on Gray Scale.
- F. When required by code, the assembly shall meet the performance requirements of NFPA 285. Exposed fastening assemblies listed in ICC ESR #3340 or Concealed fastening assemblies with Engineering Evaluation report(s) from a nationally recognized fire protection consulting firm. Any variations must be approved by the lo
- G. Façade Panel Framing: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
  - 1. Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
- H. Extruded Aluminum Trim: Color as specified in the finish schedule.
- I. Sub-Frame, Reveal and Surround Finish: Black Anodized Aluminum.
- J. Fasteners (Concealed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the architect.
- K. Joint Closure Piece: Refer to Drawings for locations.
  - 1. Color: Black.
- L. Panel Corner Profile: Refer to Drawings for corner conditions.

### 2.5 AUXILIARY MATERIALS (PROVIDED BY INSTALLING CONTRACTOR)

- A. Thermal Insulation: Mineral wool insulation complying with ASTM C612; noncombustible, nondeteriorating and inorganic, repels and drains water, and acceptable to wall panel system manufacturer. Refer to Section 07 2100 - Building Insulation.
  - 1. Thickness: As indicated on drawings.

### 2.6 FABRICATION

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- A. Fabricate solid phenolic wall panels and accessory items in accordance with manufacturer's written recommendations and approved submittals.
- B. Fabricate panels with a minimum of 1mm micro bevel on the exposed face.
- C. Comply with indicated profiles and within dimensional and structural requirements. Fabricator shop drawings to comply with manufacturer's written guidelines for ventilation of the rainscreen façade.

### PART 3 - EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product installation instructions and published technical guidelines.

#### 3.2 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Verify that air and weather resistant barrier has been installed over structural sheathing in accordance with air barrier Manufacturer's recommended installation instructions and terminated properly at openings to prevent air infiltration or water penetration.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.3 INSTALLATION

- A. Install wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and Shop Drawings.
- B. Fasten solid phenolic wall panels to supporting aluminum substructure with fasteners approved for use by solid phenolic rainscreen manufacturer for use with adjoining construction and in accordance with approved Shop Drawings.
- C. Accessory Items: Install corner profiles, gaskets and trim with fasteners and adhesive appropriate for use with adjoining construction as indicated on approved Shop Drawings and as recommended by manufacturer.
- D. Do not apply sealant to solid phenolic rainscreen panel joinery unless otherwise indicated on approved Shop Drawings or in accordance with the Manufacturer's recommended installation instructions.

#### 3.4 ADJUSTING AND CLEANING

- A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.
- B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.



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- C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.
- D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

### 3.5 PROTECTION

- A. After installation, the General Contractor shall protect the wall panel system from damage. The panels shall be kept free from paint, plaster, cement scratches, or any other destructive forces.

**END OF SECTION 07 4233**

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**SECTION 07 4619  
CORRUGATED METAL PANELS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Corrugated, Galvalume/Zincalume Painted Steel siding panels, fasteners and accessory components.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing.
- B. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.
- C. Section 07 2726 - Fluid-Applied Membrane Air Barriers: Weather barrier under wall panels.
- D. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- E. Section 09 2116 - Gypsum Board Assemblies: Wall panel substrate.

**1.3 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's product literature for the exposed fastener profiled (corrugated) lap-seam metal wall panel system as specified.
- C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- D. Submit five (5) samples, 12 inches square of finished metal panels showing corrugation, and finish.

**1.5 QUALIFICATIONS**

- A. Manufacturer: Company specializing in the manufacture of products specified in this section with a minimum ten (10) years experience.

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- B. Installer: Company specializing in the installation of products specified in this section with a minimum five (5) years experience.

### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials which may cause discoloration or staining.

### 1.7 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds, for additional warranty requirements.
- B. Manufacturer's Factory Warranty
  - 1. Manufacturer's standard coating performance warranty, as available for specified installation and environmental conditions. (Contact an AEP Span representative to determine actual warranty criteria.)
- C. Contractor's Warranty
  - 1. Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for two (2) years following Project Substantial Completion date.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Morin Corporation, [www.morincorp.com](http://www.morincorp.com)
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. AEP Span: A Division of ASC Profiles Inc, 2110 Enterprise Boulevard, West Sacramento, Calif 95691 800-733-4955.
  - 2. MBCI.
  - 3. Corrugated Metals.
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 MATERIALS

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- A. Steel: Conforming to ASTM A792 Zincolume/Galvalume, minimum yield 50,000 psi, 24 gauge.
- B. Fasteners: Manufacturer's standard type to suit application; stainless steel, with neoprene gaskets.
- C. Trim, Closure Pieces, Caps and Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles. Provide neoprene closures at panel edges where indicated on drawings. Set closures in silicone sealant.

### 2.3 CORRUGATED PANELS

- A. Basis of Design: Exposed C-29 Profile A.
- B. Fabricated panels with net coverage of 29 inches with corrugations 7/8 inch deep. Corrugations shall be basic curved wave pattern.
- C. Perforations to be 1/8 inch diameter holes on 1/4 inch staggered centers and shall provide 27 percent open area.
- D. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- E. Form pieces in longest practical lengths.
- F. Finish: Galvanized

### 2.4 MATERIALS

- A. Panels:
  - 1. Base Metal:
    - a. Material:
      - 1) Steel conforming to ASTM A792 Zincolume®/Galvalume®, minimum yield 50,000 psi, thickness 22 gauge (non-standard).
        - (a) For primers thicker than 0.5 mil or if gauge is 20 or 18 Steel conforming to ASTM A653 (formerly ASTM A446), G-90 Galvanized, minimum yield 40,000 psi, thickness 22 gauge (non-standard).
      - 2) Protective Coating:
        - (a) Conform to ASTM A792, AZ50 (Zincolume/Galvalume).
        - (b) For primers thicker than 0.5 mil Conform to ASTM A924 (formerly ASTM A525) G-90 Galvanized.
    - 2. Exterior Finish: (choose one)
      - a. DuraTech® 5000 (Polyvinylidene Fluoride), full 70% Kynar® 500/Hylar 5000® consisting of a baked-on 0.15-0.20 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 10-30% when tested in accordance with ASTM D523- 14 at 60°.
  - 3. Interior Finish:

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- a. Primer Coat Material: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; finish coat material: polyester paint, finish coat dry film thickness: 0.35 mils.
  - 1) Color: Off-White
- 4. Color:
  - a. Refer to Drawings and Material Schedule.
    - 1) Finish color to be applied to all sides of the panels.

### 2.5 FABRICATION

- A. Unless otherwise shown on drawings or specified herein, panels shall be full length. Fabricate flashings and accessories in longest practical lengths.
- B. Roofing panels shall be factory formed. Field formed panels are not acceptable.

### 2.6 ACCESSORIES

- A. All fasteners shall be non-corrosive type, as recommended by the panel manufacturer. Provide self-tapping screws and other suitable fasteners designed to withstand building design loads; exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC or neoprene sealing washers.
- B. Flashing: Unless noted otherwise, shall be same material and gauge as for panel where exposed, unless noted otherwise.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions
  - 1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
  - 2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

### 3.2 PREPARATION

- A. Field Measurements:
  - 1. Verify prior to fabrication.
  - 2. If field measurements differ from drawing dimensions, notify Architect/Engineer prior to fabrication.
- B. Protection:
  - 1. Treat, or isolate with protective material, and contacting surfaces of dissimilar materials to prevent electrolytic corrosion.

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2. Require workmen who will be walking on Roofing Panels to wear clean, soft-soled work shoes that will not pick up stones or other abrasive material, which could cause damage or discoloration.
3. Protect work of other trades against damage and discoloration.

### C. Surface Preparation

1. Clean and dry surfaces prior to applying sealant.

## 3.3 INSTALLATION

### A. Panels:

1. Follow roof panel manufacturer's directions.
2. Install all panels in orientation shown on drawings.
3. Lap panels away from prevailing wind direction.
4. Fasten siding to structural supports; aligned, level, and plumb. Do not stretch or compress panel side-laps. Secure panels without warp or deflection.
5. Provide for expansion where indicated and where recommended by manufacturer.
6. Install fasteners at equal spacing, plumb, level, and in a straight line consistent with corrugation lines and building lines.
7. Locate joints over supports. End lap minimum 2 inches, greater if recommended by manufacturer.
8. Do not stretch or compress panel side-laps.
9. Secure panels without warp or deflection.

### B. Allowable Erection Tolerance

1. Maximum Alignment Variation: 1/4 inch in 40 feet.

### C. Flashing

1. Follow manufacturer's directions and architect approved Shop Drawings.
2. Install flashings to allow for thermal movement.
3. Remove strippable protective film, if used, immediately preceding flashing installation.

### D. Cutting and Fitting

1. Neat, square and true. Torch cutting is prohibited where cut is exposed to final view.
2. Where cutting and fitting is required, saw cut panels and debur cut edges. Reinforce all openings larger than 6 inches as recommended by manufacturer. All cuts shall be neat, square and true.
3. Where necessary to saw-cut panels, debur cut edges.

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### 3.4 CLEANING

#### A. Panel Damage and Finish Scratches

1. Do not apply touch-up paint to damaged paint areas that involve minor scratches.
2. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect's or Owner's representative.

#### B. Cleaning and Repairing

1. At completion of each day's work and at work completion, sweep panels, flashings and gutters clean. Do not allow fasteners, cuttings, filings or scraps to accumulate.
2. Remove debris from project site upon work completion or sooner, if directed.

**END OF SECTION 07 4619**

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**SECTION 07 5419  
POLYVINYL-CHLORIDE ROOFING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Mechanically attached polyvinyl-chloride (PVC) single-ply membrane roofing, over insulation.
- B. Roof boards.
- C. Vapor retarder.
- D. Insulation.
- E. Flashings.
- F. Walkway protection.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 3100 - Steel Decking: Placement of acoustical insulation for deck flutes.

**1.3 REFERENCE STANDARDS**

- A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2022.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2023a.
- F. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers 2015 (Reapproved 2022).
- G. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer 2016 (Reapproved 2022).
- H. ASTM D751 - Standard Test Methods for Coated Fabrics 2019.
- I. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing 2021.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.



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- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- M. FM (AG) - FM Approval Guide Current Edition.
- N. FM DS 1-28 - Wind Design 2015, with Editorial Revision (2022).
- O. NRCA (RM) - The NRCA Roofing Manual 2023.
- P. NRCA (WM) - The NRCA Waterproofing Manual 2021.
- Q. UL (DIR) - Online Certifications Directory Current Edition.

### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation, installation procedures, coordinating, and scheduling required with related work.

### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Submit roofing shop drawings for unusual conditions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Testing firm's qualification statement.
- J. Sustainable Design Documentation: Test report showing solar reflectance index of membrane.
- K. Executed warranty.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum fifteen years of documented experience.

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- B. Installer Qualifications: Company specializing in performing work of this section with at least five years of documented experience.
- C. Testing Firm Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.
- D. FM 1-75 requirements using systems which meet FM certifications.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials do not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

### 1.8 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 120 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of the day.

### 1.9 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds for additional warranty requirements.
- B. The roofing manufacturer's minimum requirements to ensure that a warranty can be provided on the State's Roofing System Warranty Form.
- C. Manufacturer's Full System Warranty: Provide 30-year manufacturer's system warranty for repair or replacement of roofing that leaks or is damaged due to wind or other natural causes commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.
- D. Applicator's Warranty: Signed by installing applicator, covering the work of a System Warranty, including all components of roofing system installation such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, expansion joints, and walkway products, for the following warranty period:
  - 1. Warranty Period: 5 years from date of substantial completion.

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**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis of Design: Sika Sarnafil & Sika Corporation - Roofing.
  - 1. Address: 100 Dan Road, Canton, MA 02021.
  - 2. Telephone: (800) 451-2504 & Sales (866) 255-3738.
  - 3. Website: [usa.sika.com/sarnafil/#sle](http://usa.sika.com/sarnafil/#sle).
- B. Acceptable Manufacturers:
  - 1. Duro-Last Roofing: [www.duro-last.com](http://www.duro-last.com)
  - 2. Carlisle SynTec Systems: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 3. Or Equal.
  - 4. Substitutions: See Section 01 2500 - Substitution Procedures.

**2.2 APPLICATIONS**

- A. Polyvinyl-Chloride (PVC) Single-Ply Membrane Roofing:
  - 1. Adhered, over insulation.

**2.3 MEMBRANE ROOFING SYSTEMS**

- A. Polyvinyl-Chloride (PVC) Adhered Roofing Systems:
  - 1. Sika Sarnafil Inc; Sarnafil G 410 SA EnergySmart.

**2.4 PERFORMANCE REQUIREMENTS**

- A. Thermoplastic Polyvinyl-Chloride (PVC) Roofing Membrane: Single-ply, fully-adhered membrane over insulation with vapor retarder and cover boards as indicated on drawings.
- B. Roofing Membrane Materials:
  - 1. Polyvinyl Chloride (PVC): Comply with ASTM D4434/D4434M, Type II for Sarnafil G fiberglass-reinforced adhered membranes.
    - a. Thickness: 72 mil, 0.072 inch, minimum, in accordance with ASTM D751 test method.
  - 2. Sheet Width: 10 feet.
    - a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for an extended period during installation.
  - 3. Solar Reflectance for EnergySmart Membranes and Color: At least 0.84 - White for initial and 0.74 - White for 3 years in accordance with ASTM C1549 test method.

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4. Thermal Emittance for EnergySmart Membranes and Color: At least 0.86 - White for initial and 0.85 - White for 3 years in accordance with ASTM C1371 test method.
  5. Factory Mutual Classification: Class 1, with windstorm resistance of 1-75 in accordance with FM DS 1-28, and secure attachment of roof deck and above-deck components in accordance with FM DS 1-29.
  6. Wind Uplift Resistance:
    - a. Designed to withstand wind uplift forces calculated in accordance with ASCE 7.
    - b. Design Wind Speed: In accordance with local building code and authorities having jurisdiction (AHJ).
  7. Roof Covering External Fire Resistance Classification: Class A, comply with UL (DIR).
  8. Rated roof insulation: To FM Approval 4450/4470, Class 1-90.
  9. Hail damage resistance: To FM 4470, Class 1-SH.
  10. Impact resistance: To FM 4473, Class 4 and UL 2218, Class 4.
- C. Roofing Assembly: Components, from bottom-up and installed in coordination with roofing system.
1. Roof deck boards.
  2. Vapor retarder.
  3. Insulation.
  4. Roof cover boards.
  5. Roofing membrane.
- D. Insulation Type - Constant and Tapered Thickness Application:
1. For Adhered PVC Membrane:
    - a. Polyisocyanurate (ISO) insulation board.

### 2.5 VAPOR RETARDERS

- A. Vapor Retarder: Self-adhered styrene-butadiene-styrene (SBS) modified bitumen with a tri-laminated woven polyethylene facer and self-adhered backside covered by release liner.
1. Thickness: 31 mil, 0.031 inch, nominal.
  2. Water Vapor Transmission: 0.018 perm in accordance with ASTM E96/E96M, using Desiccant Method.
  3. Products:
    - a. Sika Sarnafil Inc; Vapor Retarder SA 31.

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### 2.6 INSULATION

A. Polyisocyanurate (ISO) Board Insulation with Facers on Both Sides: Rigid, closed-cell, ISO insulation board complying with ASTM C1289.

1. Facers: Coated glass facers.
2. Classifications:
  - a. Type II:
    - 1) Class 2 - Faced with coated polymer-bonded glass fiber mat facers on both major surfaces of core foam
3. Compressive Strength:
  - a. Classes 1-2-3, Grade 3 - 25 psi, minimum.
4. Thermal Resistance: R-value, at 1-1/2 inch thick and 75 degrees F mean temperature, as follows:

<u>Average LTTR Value*</u>	<u>Thickness</u>	<u>Slope</u>
8.6	0.5 – 2.5" (12 – 63 mm)	1/2" per ft (4 %)

\*LTTR (long term thermal resistance) values are based on ASTM C1289. Test samples were third-party selected and tested by an accredited material testing laboratory. The LTTR results were reviewed by FM Global and certified by the PIMA Quality Mark Program.

- a. R-30 minimum.
5. Flame Spread Index (FSI): Class A, 25 to 60, when tested in accordance with ASTM E84.
6. Smoke Developed Index (SDI): Class A, 50 to 170, when tested in accordance with ASTM E84.
7. Board Size: 48 by 96 inches.
8. Board Thickness: As indicated on drawings.
9. Board Edges: Square.
10. Tapered Board: Slope as indicated; minimum thickness 1 inch; fabricate of fewest layers possible.
  - a. Sarnatherm GC tapered is a sloped rigid closed cell polyisocyanurate insulation board with fiber reinforced felt facers. Sarnatherm GC Tapered is designed to achieve positive drainage, prevent ponding water.
11. Water Vapor Permeance: Less than 4 perm at 1 inch thick, and tested in accordance with ASTM E96/E96M.
12. Basis of Design Products:
  - a. Sika Sarnafil Inc; Sarnatherm CG.

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- b. Sarnatherm CG tapered.

### 2.7 ROOF BOARDS

- A. Gypsum Roof Boards: Gypsum roof board with a primed fiberglass mat facer on one side, complying with ASTM C1177/C1177M.

- 1. Flame Spread Index (FSI): Class A, Zero, when tested in accordance with ASTM E84.
- 2. Smoke Developed Index (SDI): Class A, Zero, when tested in accordance with ASTM E84.
- 3. Board Size: 48 by 96 inches.
- 4. Board Thickness: 1/2 inch, nominal.
- 5. Compressive Strength: 900 psi, nominal.

- 6. Products:

- a. DensDeck Prime: [www.gpgypsum.com](http://www.gpgypsum.com).

- b. Or Equal.

- B. Gypsum Roof Boards: Gypsum roof board with a primed fiberglass mat facer on one side, complying with ASTM C1177/C1177M Type X - Special fire-resistant, and tested in accordance with ASTM E119.

- 1. Board Size: 48 by 96 inches.
- 2. Board Thickness: 5/8 inch, nominal.
- 3. Compressive Strength: 900 psi, nominal.

- 4. Products:

- a. DensDeck Prime: [www.gpgypsum.com](http://www.gpgypsum.com).

- b. Or Equal.

### 2.8 INSULATION/ROOF BOARD ADHESIVES

- A. Manufacturer's Standard adhesive for specified System.

### 2.9 ADHERED MEMBRANE ADHESIVES

- A. Solvent-based reactivating adhesive used to adhere bareback membrane to substrate.

- 1. Products:

- a. Sika Sarnafil Inc; Sarnacol-2170.

- B. VOC compliant, solvent-based reactivating adhesive used to adhere bareback membrane to substrate.

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1. Volatile Organic Compound (VOC) Content: 0 fl oz/gal with EPA exemptions, and 46.5 fl oz/gal without EPA exemptions. Check local jurisdiction for VOC compliance.
2. Products:
  - a. Sika Sarnafil Inc; Sarnacol-2170 VC Adhesive.

### 2.10 ATTACHMENT COMPONENTS

#### A. Attachment Plates for Insulation and Roof Boards:

1. Manufacturer's Standard plates for specified System.
2. Stress Plate: 26 gauge, 0.0179 inch thick, 3- by 3- inch square or 3-inch round steel plate with galvalume coating, used with #12, #14, and #15 Sarnafasteners to attach Sarnatherm insulation and roof boards, gypsum roof boards, or other boards to roof deck before installation of PVC mechanically-attached or adhered roof membrane.

##### a. Products:

- 1) Sika Sarnafil Inc; Sarnaplate.

#### B. Fasteners:

1. #12 Screws: Corrosion-resistant carbon steel fastener used with Sarnaplates within Sarnafil roof systems to attach Sarnatherm insulation and roof boards, gypsum roof boards, or other boards into steel decking, wood plank, or wood sheathing.

##### a. Thread Diameter: 0.220 inch, nominal.

##### b. Length: As indicated on drawings.

##### c. Products:

- 1) Sika Sarnafil Inc; Sarnafastener #12.

### 2.11 FLASHING

#### A. Wall/Curb Flashing: PVC membrane flashings.

##### 1. Products:

##### a. Sika Sarnafil Inc; Sarnafil G 410.

##### b. Sika Sarnafil Inc; Sarnafil G 410 SA Flashing Membrane.

##### c. Sika Sarnafil Inc; Sarnafil G 459 Flashing Membrane.

##### d. Sika Sarnafil Inc; Detail Membrane PVC.

#### B. Sheet Metal Flashing: PVC-coated, heat-weldable sheet metal for use as perimeter edge, wall, or curb flashing.

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1. Metal Sheet: Galvanized steel complying with ASTM A653/A653M, with G90/Z275 zinc coating and at least 24-gauge, 0.0239-inch thick base metal, and 20 mil, 0.020 inch thick PVC coating laminated on one side.
  2. Sheet Overall Size: 48 by 96 inches, nominal.
  3. Color: As selected by Architect.
  4. Products:
    - a. Sika Sarnafil Inc; Sarnaclad.
- C. Miscellaneous Flashing:
1. Circles: Injection-molded, non-reinforced, prefabricated circle, 60 mil, 0.060 inch thick, and 4-1/2 inches in diameter.
    - a. Color: As selected by Architect.
    - b. Products:
      - 1) Sika Sarnafil Inc; Sarnacircles.
  2. Outside Corner: Injection-molded, non-reinforced, prefabricated outside corner, 60 mil, 0.060 inch thick, and used as part of curb and wall flashing details.
    - a. Color: As selected by Architect.
    - b. Products:
      - 1) Sika Sarnafil Inc; Sarnacorners-Outside.
  3. Stack/Pipe Boot: Injection-molded, non-reinforced, prefabricated stack/pipe boot, 60 mil, 0.060 inch thick, and used to flash pipes, vent stacks, and cylindrical penetrations.
    - a. Color: As selected by Architect.
    - b. Penetration Diameter: As indicated on drawings.
    - c. Products:
      - 1) Sika Sarnafil Inc; Sarnastack Universal.
  4. Stack/Pipe Boot: Made from Sarnafil G 410 roofing membrane, prefabricated stack/pipe boot, 60 mil, 0.060 inch thick, and used to flash pipes, vent stacks, and cylindrical penetrations when Sarnastack Universal will not fit.
    - a. Color: As selected by Architect.
    - b. Penetration Diameter: 3/4 to 3 inches.
    - c. Products:



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- D. Counterflashing: Heavy-duty extruded aluminum counterflashing with predrilled holes at 8 inches on center for attachment to walls and curbs.
  - 1. Thickness: 0.10 to 0.12 inch, nominal.
  - 2. Profile Depth: 2-1/4 inches, nominal.
  - 3. Products:
    - a. Sika Sarnafil Inc; Sarnareglet.
- E. Liquid Flashing:
  - 1. Primer: Two-component, polymethyl methacrylate (PMMA) based primer used to promote adhesion of Liquid Flashing SW and Liquid Flashing WW over wood and concrete substrates.
    - a. Products:
      - 1) Sika Sarnafil Inc; Liquid Flashing Primer.

### 2.12 WALKWAY PROTECTION

- A. Chevron Textured Mat: Polyester reinforced, 96 mil, 0.096 inch thick, weldable PVC membrane with chevron textured surface embossment, used as a protection layer from rooftop traffic.
  - 1. Color: Light gray.
  - 2. Width: 39 inches, nominal.
  - 3. Tensile Strength: 275 psi in accordance with ASTM D751 test method.
  - 4. Products:
    - a. Sika Sarnafil Inc; Sarnatred-V.
- B. Perimeter Warning Materials:
  - 1. Reflective Tape: Reflective, highly visible yellow-colored tape with a back side release liner, 2 inches wide, used in required areas on PVC roofing membrane to draw attention to roof perimeters and potentially hazardous areas.
    - a. Products:
      - 1) Sika Sarnafil Inc; Perimeter Warning Tape.
  - 2. Membrane Tape: Highly visible, with yellow top-colored PVC membrane, 4 inches wide and hot-air welded to PVC roofing membrane, used in required areas to draw attention to roof perimeters and potentially hazardous areas.
    - a. Products:
      - 1) Sika Sarnafil Inc; Perimeter Warning Membrane.

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### 2.13 ACCESSORIES

- A. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.
- B. Fasteners and Anchors: Provide fasteners, anchors, nails, straps, and bars that are post-galvanized steel, aluminum, or stainless steel.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive this work.
- B. Verify that roof deck and existing roof construction are structurally sound and able to provide proper support for new roofing system.
- C. Verify roof deck surfaces are clean and smooth, flat, free of flaws, depressions, sharp edges, loose and foreign material, waves, projections, properly sloped, and suitable for installation of roof system.
- D. Verify roof deck surfaces are dry and free of snow or ice, oil, grease, and other contaminants.
- E. Verify that roof deck openings, curbs, and penetrations through roof decking such as drains and scuppers are solidly set, and cant strips, nailing strips, and reglets are properly placed.

#### 3.2 PREPARATION

- A. Owner's representative to verify that roof deck is properly secured to structural framing in accordance with local building code, and capable of resisting anticipated loads to that location.
- B. Metal Deck:
  - 1. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see Section 05 3100.
  - 2. Install Deck Sheathing on Metal Deck:
    - a. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
    - b. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
    - c. Tape joints.
    - d. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.
      - 1) Over entire roof area, fasten sheathing using six fasteners with washers per sheathing board.
      - 2) At roof perimeter to a distance of 4 feet in from edges, fasten sheathing using six fasteners with washers per board.

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### 3.3 INSTALLATION

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate this work with installation of associated counterflashings installed by others as this work proceeds.
- G. Vapor Retarders:
  - 1. Install vapor retarder over deck surface in accordance with manufacturer's instructions.
    - a. Overlap edges of sheets as required by manufacturer.
    - b. Apply primer to substrate as required by manufacturer.
    - c. Extend vapor retarder under cant strips and blocking to deck edge.
    - d. Install flexible flashing from vapor retarder to air seal material of wall construction, lap, and seal to provide continuity of the air barrier plane.
  - 2. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
- H. Insulation:
  - 1. Attachment of Insulation:
    - a. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual FM DS 1-28 requirements.
    - b. Embed the second layer of insulation into full bed of adhesive in accordance with roofing manufacturer's instructions.
  - 2. Comply with wind uplift rating requirements and associated fastener patterns.
  - 3. Lay subsequent layers of insulation with joints staggered at least 12 inches from joints of preceding layer.
  - 4. Place tapered insulation to the required slope pattern in accordance with roofing manufacturer's instructions.
  - 5. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

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6. Lay boards with edges in moderate contact without forcing, and cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
  7. Tape joints of insulation in accordance with roofing and insulation manufacturer's instructions.
  8. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches, minimum.
  9. Do not install more insulation than can be covered with membrane on same day.
- I. Roof Deck/Cover Boards:
1. Mechanically fasten roof deck/cover boards in accordance with roofing manufacturer's instructions and Factory Mutual FM (AG) requirements.
- J. Membrane:
1. Adhered Membrane Attachment:
    - a. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
    - b. Shingle joints on sloped substrate in direction of drainage.
    - c. Fully Adhered Application: Apply adhesive to substrate at rate of \_\_\_ gallons per square foot. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
    - d. Overlap edges and ends and seal seams by hot-air welding, minimum 3 inches overlap for machine welding, and minimum 4 inches wide when hand-welding; seal permanently waterproof.
  2. At intersections with vertical surfaces:
    - a. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
    - b. Fully adhere flexible flashing over membrane and up to nailing strips.
    - c. Secure flashing to nailing strips at 4 inches on center.
    - d. Insert flashing into reglets and secure.
- K. Flashing: Install flashings concurrently with roof membrane; temporary flashings are not allowed without the prior written approval of Owner's Representative and manufacturer.
1. Membrane Flashing: Adhere membrane flashing onto compatible, dry, and smooth surfaces free of dirt, dust, and debris; use caution to ensure adhesive fumes are not drawn into the building.
    - a. Extend flashings at least 8 inches above finished roofing level.
    - b. Mechanically fasten flashing membranes along the counter-flashed top edge with Sarnastop or approved Sarnadisc at 6 to 12 inches on center.

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- c. Provide adhered flashings that exceed 45 inches in height with additional securement, unless applying G 410 SA membrane to plywood, DensDeck Prime, concrete masonry units, or cast-in-place concrete.
  - d. Refer to Typical Flashing Procedures section of Sika Sarnafil Roofing Applicator Handbook for detailed installation instructions.
2. Liquid Flashing: Due to the strong odor of liquid flashing, take the necessary precautions to prevent odors and/or vapors from entering the building interior including, but not limited to, turning off and sealing air intake vents and other means of ingress for odors and/or vapors during product application and curing.
- a. Prepare flashing surfaces to be in extremely clean condition.
  - b. Pre-cut liquid flashing fleece to fit around vertical and horizontal penetration with at least 2-inch overlaps.
  - c. Apply catalyzed liquid flashing with at least 55 mil, 0.055 inch thick base layer, and place pre-cut fleece onto wet liquid flashing and ensure fleece is saturated, and apply at least 25 mil, 0.025 inch thick finish layer over fleece.
  - d. Refer to Liquid Flashing Procedures section of Sika Sarnafil Roofing Applicator Handbook for detailed installation instructions.
3. Metal Base Flashing and Edge Metal: Comply with the following for metal details, fabrication practices, and installation methods:
- a. ANSI/SPRI/FM 4435/ES-1, and Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
  - b. Install preformed metal flashing in accordance with metal manufacturer's guidelines.
  - c. Install and form Sarnaclad and other metal flashings in accordance with detail drawings; refer to Metal Flashings section of Sika Sarnafil Roofing Applicator Handbook for detailed installation instructions.
- L. Walkway: Refer to Walkway Installation section of Sika Sarnafil Roofing Applicator Handbook for detailed installation instructions.
1. Chevron Textured Mat: Examine existing deck membrane seams to be covered by Sarnatred-V mat, and install walkway mat in straight line by either adhering and welding or just welding to roof membrane in accordance with manufacturer's installation instructions.
- M. Perimeter Warning: Ensure that perimeter warning installation substrates are extremely clean.
1. Tape: Apply warning tape with hand pressure to top of PVC roofing membrane in areas as indicated on drawings.
  2. Membrane: Apply warning membrane using hot-air welding to top of PVC roofing membrane in areas as indicated on drawings.

### 3.4 FIELD QUALITY CONTROL

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- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Owner will provide testing and inspection services, and Contractor will provide temporary construction and materials for testing.
- C. Water Test:
  - 1. A 60-hr. water test of all completed roof systems, including low-slope and metal roofing, as well as adjacent building components, shall be coordinated with the Owner and conducted by the Contractor in the presence of Owner. The water test shall include the following procedures:
    - a. At the direction of the Owner, apply simulated rain over all roof areas for at least 15 minutes per area, or as otherwise directed.
    - b. In addition to the simulated rain, direct water to all walls, windows, units, penetrations, etc. that occur adjacent to, or within each roof area, using a continuous, unforced hose stream.
    - c. Plug all roof drains in each drainage area and allow each to be filled to a depth of 3 to 4 inches measured at the drain areas. Allow to stand for a minimum of 4 hours.
    - d. Upon completion of water test, unplug primary drains only and insure that water flows freely without restriction. Verify that no water comes through overflow drain outlets (to insure that pipes are not cross-connected). Then unplug overflow drains and run hose stream directly into overflow drains to insure that water flows freely without restriction through overflow lines.
    - e. Perform any necessary corrections to defects noted during or after the water test procedures. Perform additional testing as necessary to further define sources of any noted leakage.
    - f. Contractor shall provide and/or arrange for all necessary equipment, supplies, water, etc. as needed to perform these tests. This may include a water truck with fire hose, if necessary.
    - g. Water test shall be performed after completion of asphalt paving, and must be completed and verified prior to filing for substantial completion.
- D. A final audit punch list shall be made by the Architect upon notice by the General Contractor that roofing is complete. The roofing and related work must be 100% complete or additional inspections will be back charged.
- E. Manufacturer's technical representative shall make periodic site visits and complete inspection reports that are submitted to the owner. At least one visit per roof area not including final inspections. Final inspections by the roofing membrane manufacturer shall be coordinated at least two weeks in advance with the owner / owner's consultant so that their attendance can be properly coordinated. Final inspection reports and signed / completed punch list reports by the roofing membrane manufacturer shall be submitted to the owner. Submittal of the roofing warranty alone shall not be acceptable.

### 3.5 CLEANING

- A. See Section 01 7300 - Execution Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.

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- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.6 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over the finished roof membrane, protect surfaces using durable materials.

**END OF SECTION 07 5419**

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**SECTION 07 6200  
SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

**1.2 RELATED REQUIREMENTS**

- A. Section 07 6100 - Sheet Metal Roofing.
- B. Section 07 7113 - Premanufactured Metal Coping and Edge Systems.
- C. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.

**1.3 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- F. CDA A4050 - Copper in Architecture - Handbook current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

**1.4 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

**1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.



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- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

## PART 2 PRODUCTS

### 2.1 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
  - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
- B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

### 2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

### 2.3 EXTERIOR PENETRATION FLASHING PANELS

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

### 2.4 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.

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- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

#### **3.2 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

#### **3.3 INSTALLATION**

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

#### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION 07 6200**

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**SECTION 07 7113  
PREMANUFACTURED METAL COPING AND EDGE SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Work included: Factory fabricated and finished coping system and edge system.
- B. Work shall be performed by Roofing Contractor as integral part of roofing system assembly and warranty.

**1.2 RELATED DOCUMENTS:**

- A. Section 04 2000 - Unit Masonry
- B. Section 07 4113 - Metal Roof Panels
- C. Section 07 42 33 - Phenolic Wall Panels.
- D. Section 07 42 47 - Ultra High Performance Concrete Panels.
- E. Section 07 44 00 - Double Ventilated Facade System
- F. Section 07 5419 - PVC Thermoplastic Single-Ply Roofing - Carlisle
- G. Section 07 6200 - Sheet Metal Flashing and Trim

**1.3 REFERENCE STANDARDS**

- A. Factory Mutual (FM Global) ([www.fmglobal.com](http://www.fmglobal.com)).
- B. Single Ply Roofing Industry (SPRI) ([www.spri.org](http://www.spri.org)):
- C. ANSI/SPRI/FM 4435/ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

**1.4 PREINSTALLATION MEETINGS**

- A. Convene preinstallation meeting 1 week before start of installation of coping system.
- B. Require attendance of parties directly affecting Work of this Section, including Contractor, Architect, installer, and manufacturer's representative.
- C. Review the Following:
  - 1. Materials.
  - 2. Examination of roof edge areas.
  - 3. Installation.

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4. Cleaning.
5. Protection.
6. Coordination with other Work, including roofing installation.

### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide Manufacturer's product and complete installation data for all materials in this Specification.
- C. Shop Drawings: Show profiles, joining method, accessory location, anchorage and flashing details, adjacent construction interface, and dimensions.
- D. Color Samples: Submit manufacturer's color samples of snap-on coping cap, consisting of complete set of metal color chips representing manufacturer's full range of available colors.
- E. Installation Guide: The product Manufacturer shall provide a written installation guide.
- F. Warranty Documentation: Submit manufacturer's standard warranty.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in the manufacturing of coping systems of similar type to that specified for a minimum of 5 years.
- B. Installer's Qualifications:
  1. Installer regularly engaged in installation of coping systems of similar type to that specified for a minimum of 5 years.
  2. Use persons trained for installation of coping systems.
- C. IBC 2018 / 1504.5: ANSI/SPRI ES-1 Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems. All configurations, gauges, attachments and other items shall meet or exceed testing and design criteria related to ES-1 and IBC 1504.5.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
  1. Store and handle materials in accordance with manufacturer's instructions.
  2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
  3. Store materials in clean, dry area indoors.

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4. Do not store materials directly on floor or ground.
  5. Protect materials and finish during storage, handling, and installation to prevent damage.
  6. The Contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective plastic surface film immediately after installation.

### 1.8 JOB CONDITIONS

- A. Verify that other trades with related work are complete before mounting coping covers.
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the Construction Documents, shop drawings and Manufacturer's installation instructions.
- D. Coordinate installation with roof membrane Manufacturer's installation instructions before starting.

### 1.9 WARRANTY

- A. Refer to Section 01 7836 - Warranties and Bonds for additional warranty requirements.
- B. Special Warranty: Warranted in wind conditions up to 110 mph with a 20-year wind warranty.
  1. PermaSnap Coping System: Coping system shall not blow off, leak, or cause membrane roofing failure when installed in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  1. OMG EdgeSystems, 4 Commerce Way, Arden, North Carolina 28704. Toll Free 800-892-9173. Phone 828-676-1700. [www.omgedgesystems.com](http://www.omgedgesystems.com). [info@omgroofing.com](mailto:info@omgroofing.com).
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  1. Metal-Era Inc.; [www.metalera.com](http://www.metalera.com).
  2. or Approved Equal
- C. If the roofing membrane Manufacturer can provide Systems that are in conformance with this Specification, then they shall be provided by the roofing Manufacturer and included as part of the roofing system warranty.

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### 2.2 PARAPET COPING SYSTEM

#### A. Coping System Type CP-1, CP-2: "PermaSnap".

1. Description:
  - a. Snap-on coping with intermittent clips for capping parapet walls.
  - b. Watertight.
  - c. Maintenance free.
  - d. Does not require exposed fasteners or joint sealants.
2. Tested: ANSI/SPRI/FM 4435/ES-1 test pressures up to 139 psf vertical and 82 psf horizontal..
3. Approvals:
  - a. UL Classified.
4. Performance Characteristics:
  - a. Snap-on Coping Cap Sections:
    - 1) Capable of expanding and contracting freely, while mechanically locked in place on clips.
    - 2) Lock to clips by mechanical pressure from concealed splices.
  - b. Snap-on Coping Cap Joints: Underlaid with concealed splices capable of draining water.
5. Wall Width: Indicated on the Drawings.
  - a. Minimum: 6 inches.
  - b. Maximum: 24 inches.

#### B. Snap-on Coping Cap:

1. Material: 22-gauge galvanized steel.
2. Formed Lengths: 10'-0".
3. Finish: Prefinished Kynar
4. Color: Refer to Material Schedule and Drawings.
5. Face Dimension: Indicated on the Drawings.
  - a. Minimum: 4 inches.
  - b. Maximum: 12 inches.

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6. Back Dimension: Indicated on the Drawings.
  - a. Minimum: 3-1/2 inches.
  - b. Maximum: 4 inches.
- C. Intermittent Clips:
  1. Material: 20-gauge galvanized steel.
  2. Width: 12 inches.
  3. Fastener Holes: Slotted.
- D. Springs: Steel, 6 inches wide.
- E. Concealed Splices:
  1. Material: Same as snap-on coping cap.
  2. Finish and Color: Same as snap-on coping cap.
  3. Width: 6 inches.
  4. Integral gutter to channel water back to roof.
- F. Fasteners:
  1. Universal Fasteners: E-coated, corrosion-resistant.
  2. Suitable for intended substrate.
  3. Provided by coping system manufacturer.
  4. No exposed fasteners.
- G. Factory-Fabricated Accessories:
  1. Miters.
  2. End caps.
  3. End terms.
  4. Material, Finish, and Color: Same as snap-on coping cap.
  5. Fabrication: Metal-Lok.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine roof edge areas, including roofing and blocking, to receive coping system.

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- B. Verify surfaces to support coping system are clean, dry, flat, level from front to back, secure, and of proper dimensions.
- C. Verify that coping and edge installation will not disrupt other trades. Verify that substrate is dry, clean and free of foreign matter.
- D. Fully coordinate installation with roofing system Manufacturer's requirements and recommendations.
- E. Correct defects prior to any installation.

### 3.2 INSTALLATION

- A. Install coping system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Shim areas of walls not level from front to back.
- C. Fasteners: Install coping system using concealed fasteners in accordance with manufacturer's instructions.
- D. Install concealed splices at all clip locations.
- E. Thermal Movement: Leave 1/4-inch gap between snap-on coping cap sections to allow for thermal expansion and contraction.
- F. Do not use sealant at splices.
- G. Review lengths of straight pieces of snap-on coping cap before cutting to avoid creating relatively short sections adjacent to full-length sections.
- H. Isolate coping system from ACQ treated wood blocking or other galvanically incompatible material with appropriate membrane material.

### 3.3 CLEANING

- A. Clean coping system promptly after installation in accordance with manufacturer's instructions.
- B. Remove clear protective vinyl film.
- C. Do not use harsh cleaning materials or methods that could damage finish.

### 3.4 PROTECTION

- A. Protect installed coping system to ensure that, except for normal weathering, coping system will be without damage or deterioration at time of Substantial Completion.

**END OF SECTION 07 7113**

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**SECTION 07 7200  
ROOF ACCESSORIES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this section.

**1.2 SECTION INCLUDES**

- A. Roof curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof hatches, manual operation.
- E. Non-penetrating pedestals.

**1.3 RELATED REQUIREMENTS**

- A. Section 05 5133 - Metal Ladders: Steel Ladders.
- B. Section 07 5419 - Polyvinyl-Chloride Roofing.

**1.4 REFERENCE STANDARDS**

- A. 29 CFR 1910.23 - Ladders Current Edition.
- B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices Current Edition.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- H. UL (DIR) - Online Certifications Directory Current Edition.

**1.5 SUBMITTALS**

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- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
  - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
  - 2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in Nevada.
- D. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.
- E. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

### 1.7 WARRANTY

- A. See Section 01 7800 - Closeout Procedures and Submittals for additional warranty requirements.
- B. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 ROOF CURBS

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
  - 1. Roof Curb Mounting Substrate: Curb substrate consists of As indicated on Drawings.
  - 2. Sheet Metal Material:

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- a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.
3. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches.
4. Provide layouts and configurations indicated on drawings.
- B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
  1. Provide preservative treated wood nailers along top of curb.
  2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
- D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

### 2.2 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

- A. Roof Hatch Manufacturers:
  1. Acudor Products Inc; Galvanized Steel Roof Hatch: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  2. Babcock-Davis; ThermalMAX: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  3. Basis of Design: Bilco Company; Type E (ladder access, 3 ft square, solid cover): [www.bilco.com/#sle](http://www.bilco.com/#sle).
- B. Roof Hatches, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
  1. Style: Provide flat metal covers unless otherwise indicated.
  2. Mounting Substrate: Provide frames and curbs suitable for mounting on flat roof deck sheathing with insulation.
  3. Thermally Broken Hatches: Provide insulation within frame and cover.
  4. Size: As indicated on drawings; single-leaf style unless otherwise indicated.
  5. For Ladder Access: Single leaf; 30 by 36 inches.
- C. Metal Covers: Flush, insulated, hollow metal construction.
  1. Capable of supporting 40 psf live load.
  2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch thick, liner 0.04 inch thick.
  3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.

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4. Gasket: Neoprene, continuous around cover perimeter.
- D. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.
  1. Basis of Design Product: Model: RHSR-SS (Standard System).
  2. Railing Size: 24 by 36 inches.
  3. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
  4. Self-Closing Gate: Comply with 29 CFR 1910.29 for safe egress and fall protection through hatch opening.
  5. Posts and Rails: Galvanized steel tubing.
  6. Gate: Same material as railing; automatic closing with latch.
  7. Finish: Manufacturer's standard, factory applied finish.
  8. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.
  9. Mounting Brackets: Hot dipped galvanized steel, 1/4 inch thick, minimum.
  10. Fasteners: Stainless steel, Type 316.
  11. Products:
    - a. Basis of Design: Kee Safety, Inc.: 100 Stradtman St. Buffalo, NY 14206; Phone: 716-896-4949.
    - b. Safety Rail Company; Roof HatchGuard, Non-Penetrating Fall Protection: [www.safetyrailcompany.com/#sle](http://www.safetyrailcompany.com/#sle).
    - c. Or Approved Equal.

### 2.3 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
  1. Design Loadings and Configurations: As required by applicable codes.
  2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
  3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

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5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
- C. Duct Supports: Provide extruded aluminum supports and sized in accordance with diameter of supported ducts, and with base that is non-penetrating of roofing membrane.
- D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
  1. Bases: High density polypropylene.
  2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

#### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

#### **3.4 CLEANING**

- A. Clean installed work to like-new condition.

#### **3.5 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

### **END OF SECTION 07 7200**

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**SECTION 07 8400  
FIRESTOPPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Safing slot gaps between edge of floor slabs and curtain walls.
- C. Openings between structurally separate sections of wall or floors.
- D. Gaps between the top of walls and ceilings or roof assemblies.
- E. Expansion joints in walls and floors.
- F. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- G. Openings around structural members which penetrate floors or walls.
- H. Acoustical Fire Rated Outlet Backer Pads.
- I. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 7329 - Cutting and Patching: Cutting and patching.
- B. Section 07 9200 - Joint Sealants.
- C. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

**1.3 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2023a.

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- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2023.
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- I. ITS (DIR) - Directory of Listed Products Current Edition.
- J. FM 4991 - Approval Standard of Firestop Contractors 2013.
- K. FM (AG) - FM Approval Guide Current Edition.
- L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).
- O. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- P. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- Q. UL (DIR) - Online Certifications Directory Current Edition.
- R. UL (FRD) - Fire Resistance Directory Current Edition.
- S. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

### 1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Penetrations: Provide and install firestopping systems that are produced to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, including but not limited to the following:
  - 1. Firestop all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.
  - 2. Provide and install complete penetration firestopping systems that have been tested and approved by third party testing agency.
  - 3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E814, but not less than one hour or the fire-resistance rating of the construction being penetrated.
  - 4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated..
  - 5. L - Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings, in addition to F and T ratings, as determined per UL 1479, where indicated.

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6. (Optional) W - Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings, in addition to F, T and L ratings, as determined per UL 1479, where indicated.
- B. Perimeter Fire Containment Systems: Provide interior perimeter joint systems with fire-resistance ratings indicated, as determined per ASTM E2307, but not less than the fire-resistance rating of the floor construction.
- C. Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined per UL 2079, but not less than the fire-resistance rating of the construction in which the joint occurs.
- D. For firestopping exposed to view, traffic, moisture, and physical damage, provide firestop systems for these conditions that meet conditions expected as communicated through construction documents.
- E. Where there is no specific third party tested and listed, classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer, an Current Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRR) for submittal.

### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Schedule of Firestopping: Provide a list each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
  1. All approved firestopping assemblies including engineering judgments shall be provided and organized by trade.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- H. Certificate from authority having jurisdiction indicating approval of materials used, where applicable.
- I. Installer's qualification statement.

### 1.6 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with ASTM E814, ASTM E119, ASTM 1479, ASTM E2307, and UL 2079.
  1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

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2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
  3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.
- C. Single Source Responsibility: Obtain firestop systems for each kind of penetration and construction condition indicated from a single primary firestop systems manufacturer.
1. Materials of different manufacture than allowed by the tested and listed system shall not be intermixed in the same firestop system or opening.
  2. Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section and:
1. Trained by the direct representative of the manufacturer.
  2. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, Underwriters Laboratories (UL) Approved Contractor, or meeting any two of the following requirements:
    - a. Verification of minimum three years documented experience installing work of this type.
    - b. Verification of at least five satisfactorily completed projects of comparable size and type.
    - c. Licensed by local authorities having jurisdiction (AHJ).

### 1.7 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

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- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com), 800-879-8000
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. Firestopping Manufacturers:
    - a. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
    - b. A/D Fire Protection Systems Inc: [www.adfire.com](http://www.adfire.com).
    - c. Specified Technologies Inc: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 FIRESTOPPING - GENERAL REQUIREMENTS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- C. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- D. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- E. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- F. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- G. Fire Ratings: Refer to Drawings for required systems and ratings.

### 2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
  - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
  - 2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.

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3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
  2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
  4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
  2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated on drawings.
  3. Watertightness: In addition, provide systems that have been tested to show W Rating as indicated on drawings.
  4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

### 2.4 ACOUSTICAL FIRE-RATED PUTTY PADS:

- A. Use only backer pads that have been UL 1479 or ASTM E814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, and fire-rating involved for each separate instance.
- B. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
  1. Kinetics Noise Control Model IsoBacker: Acoustical Fire Rated Outlet Backer Pad.
- C. Pillows: Nelson PLW Firestop Pillow, Hilti FS Fire Block, dust proof chemical resistant cloth with heat-reactive expanding solidifying fill, designed for large openings that require frequent cable

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alterations.

- D. Safing Insulation: USG "Thermafiber Safing Insulation", 4 lb density mineral wool insulation unless indicated otherwise.
- E. Damming Materials: As recommended by firestop manufacturer.
- F. Manufacturers:
  - 1. Kinetics Noise Control, Dublin OH; 877-457-2695.
  - 2. 3M Fire Barrier Moldable Putty; 3M Fire Protection Products

### 2.5 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.
  - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
  - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

### 3.3 COORDINATION

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- A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector..

### 3.4 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or ITS Directory.
- B. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- C. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- D. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- E. Install labeling required by code.

### 3.5 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

### 3.6 ACOUSTIC ACCESSORIES INSTALLATION

- A. Apply acoustical putty pads completely around all electrical boxes and other items penetrating into acoustically rated walls, walls with acoustical insulation and all guestroom wall conditions.

### 3.7 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" and ASTM E2393 - 10a Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers. Inspection agency to examine firestopping and will determine, in general that firestopping has been installed in compliance with requirements of tested and listed firestop systems, and installation process conforms to FM 4911 - Standard for Approval of Firestop Contractors.

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1. The Inspector shall advise the Contractor of any deficiencies noted within one (1) working day.
  2. Do not proceed to enclose firestopping with other construction until inspection agency has verified that the firestop installation complies with the requirements.
  3. Where deficiencies are found, repair or replace the firestopping so that it complies with requirements of tested and listed systems.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- E. Manufacturer's Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

### 3.8 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- B. The Documentation Form for through penetrations is to include:
1. A Sequential Location Number
  2. The Project Name
  3. Date of Installation
  4. Detailed description of the penetrations location
  5. Tested System or Engineered Judgment Number
  6. Type of assembly penetrated
  7. A detailed description of the size and type of penetrating item
  8. Size of opening
  9. Number of sides of assemblies addressed
  10. Hourly rating to be achieved
  11. Installers Name
- C. The Documentation Form for Construction Joints is to include:
1. A Sequential Location Number
  2. The Project Name
  3. Date of Installation
  4. Detailed description of the Construction Joints location

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5. Tested System or Engineered Judgment Number
  6. Type of Construction Joint
  7. The Width of the Joint
  8. The Lineal Footage of the Joint
  9. Number of sides addressed
  10. Hourly rating to be achieved
  11. Installers Name
- D. Copies of these documents are to be provided to the general contractor at the completion of the project.
- E. Penetration Identification: Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
    - a. Contractor's Name, address, and phone number.
  2. Through-Penetration firestop system designation of applicable testing and inspecting agency.
  3. Date of Installation.
  4. Through-Penetration firestop system manufacturer's name.
  5. Installer's Name.
- F. Wall Identification: All marking and identification of firewalls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling and shall meet the following requirements:
1. Be in full compliance with Section 703.6 of the International Building Code; 2018.
  2. Be located in accessible concealed floor, floor-ceiling or attic spaces.
    - a. Height above the ceiling - from 6" to 12".
    - b. Both Sides of the wall
  3. Be repeated at intervals not exceeding 10 feet (3.04 m) measured horizontally along the wall or partition.
  4. Include lettering not less than 2 inch (50.8 mm) in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording indicating type of wall or partition.

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- a. Color: bright orange or red.

**3.9 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.10 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION 07 8400**



**SECTION 07 9200  
JOINT SEALANTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Acoustical sealants.

**1.2 RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping: Firestopping sealants.
- B. Section 09 2216 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

**1.3 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017 (Reapproved 2023).
- C. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).
- G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2023.
- I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- J. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2023.
- K. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).
- L. SWRI (VAL) - SWR Institute Validated Products Directory Current Edition.

**1.4 PERFORMANCE REQUIREMENTS**

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- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

### 1.5 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
  - 5. Substrates for which use of primer is required.
  - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
  - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  - 8. Sample product warranty.
  - 9. Certification by manufacturer indicating that product complies with specification requirements.
  - 10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Executed warranty.

### 1.6 QUALITY ASSURANCE

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- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience and approved by manufacturer.
- C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

### 1.7 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

### 1.8 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

### 1.9 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Single Source Responsibility
  - 1. For each different product, provide material from a single Manufacturer.
  - 2. Where sealants from more than one Manufacturer is used for the project, provide written certification from each Manufacturer involved that the sealants are totally compatible and will have no deleterious effect with each other.
- B. Nonsag Sealants:
  - 1. Dow: [www.dow.com/#sle](http://www.dow.com/#sle).

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2. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com/#sle](http://www.momentive.com/#sle).
3. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
4. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
5. Sika Corporation: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
7. W.R. Meadows, Inc: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
8. Or Equal.

### C. Self-Leveling Sealants:

1. Dow: [www.dow.com/#sle](http://www.dow.com/#sle).
2. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
4. Sika Corporation: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
5. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
6. W.R. Meadows, Inc: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
7. Or Equal.

## 2.2 JOINT SEALANT APPLICATIONS

### A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
  - a. Joints between door, window, and other frames and adjacent construction.
  - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound

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paths.

1) Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings. See Section 09 2116 for additional information.

2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.

c. Other joints indicated below.

3. Do not seal the following types of joints:

a. Intentional weep holes in masonry.

b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.

c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

d. Joints where installation of sealant is specified in another section.

e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.

2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.

3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.

2. Wall and Ceiling Joints in Wet Areas: Nonsag polyurethane sealant for continuous liquid immersion.

3. Floor Joints in Wet Areas: Nonsag polyurethane non-traffic-grade sealant suitable for continuous liquid immersion.

4. Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag tamper-resistant silyl-terminated polyurethane sealant.

5. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.

6. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

7. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.

8. Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

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- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.
- F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

### 2.3 JOINT SEALANTS - GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: 250 g/L.
  - 2. Non-membrane Roof Sealants: 300 g/L.
  - 3. Single-Ply Roof Membrane Sealants: 450 g/L.
  - 4. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 5. Sealant Primers for Porous Substrates: 775 g/L.
  - 6. Modified Bituminous Sealant Primers: 500 g/L.
- D. Colors: As selected by Architect/Engineer from manufacturer's full range or As indicated on drawings.

### 2.4 NONSAG JOINT SEALANTS

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
  - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  - 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  - 5. Color: Match adjacent finished surfaces.
  - 6. Products:

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- a. Dow; DOWSIL 756 SMS Building Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
  - b. Dow; DOWSIL 790 Silicone Building Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
  - c. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
  - d. Dow; DOWSIL 795 Silicone Building Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
  - e. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - f. Sika Corporation; Sikasil WS-290: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - g. Sika Corporation; Sikasil WS-295: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - h. Sika Corporation; Sikasil 728NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - i. Or Equal.
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's standard range.
  4. Cure Type: Single component, neutral moisture curing.
  5. Service Temperature Range: Minus 65 to 180 degrees F.
  6. Products:
    - a. Dow; DOWSIL 758 Silicone Weather Barrier Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
    - b. Momentive Performance Materials, Inc/GE Silicones; SCS2700 SilPruf LM (Low Modulus) - Silicone Weatherproofing Sealant: [www.siliconeforbuilding.com/#sle](http://www.siliconeforbuilding.com/#sle).
    - c. Pecora Corporation; Pecora 860: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Sika Corporation; Sikasil GP: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - e. Sika Corporation; Sikasil WS-295: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - f. Or Equal.
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.
  2. Products:
    - a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).

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- b. Sika Corporation; Sikasil GP: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - c. Or Equal.
- D. Tamper-Resistant, Silyl-Terminated Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus 50 percent, minimum
  - 2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Products:
    - a. Pecora Corporation; DynaFlex SC (Security Sealant): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; SikaHyflex-150 LM: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Or Equal.
- E. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; multi-component; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Products:
    - a. Pecora Corporation; DynaTrol II: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Pecora Corporation; DynaFlex: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - d. Sika Corporation; Sikaflex-2c NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - e. Tremco Commercial Sealants & Waterproofing; Dymonic 100: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - f. Or Equal.
- F. Epoxy Sealant: ASTM C881/C881M, Type I and III, Grade 3, Class B and C; two-component.
- 1. Hardness Range: 65 to 75, Shore D, when tested in accordance with ASTM C661.
  - 2. Compressive Strength: 11,000 psi, when tested in accordance with ASTM D695.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Service Temperature Range: 40 to 120 degrees F.

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5. Products:
  - a. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - b. Or Equal.
- G. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
  1. Color: Standard colors matching finished surfaces, Type OP (opaque).
  2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
  3. Products:
    - a. Pecora Corporation; AC-20 +Silicone: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sherwin-Williams Company; 850A Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Or Equal.
- H. Acrylic Latex Sealant, Water-Based: ASTM C834 Type OP - Opaque and Grade Minus 18 degrees C (0 degrees F); ASTM C920 Class 100/50 for white and colors, and Class 25/25 for clear.
  1. Color: To be selected by Architect from manufacturer's standard range.
  2. Application Temperature: Within range of 40 to 120 degrees F
  3. Service Temperature Range: From 0 to 160 degrees F.

### 2.5 ACOUSTICAL SEALANT

- A. Acoustical Sealant at Exposed Joints: Nonsag, paintable, nonstaining, latex sealant conforming to ASTM C834. Tested to ASTM E90 for reduction of airborne sound transmission through perimeter joints and openings in building construction at representative assemblies. Specified for type and quality:
- B. Permanently resilient sealant for use in conjunction with gypsum board; non-shrinking and non-cracking.
  1. USG "Acoustical Sealant", Tremco "Acoustical Sealant.
  2. Or Equal
- C. Acoustical Sealant at Concealed Joints:
  1. Synthetic Rubber Joint Sealant: Single component, non-skinning, non-hardening, 90 percent solids, acoustical properties conforming to ASTM C919 and to ASTM E90.

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2. Water Based Siliconized Acrylic Latex:
  - a. Install 2 beads under steel stud framing channel and wood plates and into 1/2 inch space.

### 2.6 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
  1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  3. Color: Gray.
  4. Products:
    - a. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikaflex-2c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Or Equal.
- B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multicomponent; explicitly approved by manufacturer for horizontal expansion joints.
  1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's standard range.
  4. Products:
    - a. Pecora Corporation; Urexpan NR-200: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Tremco Commercial Sealants & Waterproofing; THC-901: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - c. Or Equal
- C. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
  1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
  2. Products:
    - a. ARDEX Engineered Cements; ARDEX ARDIFIX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Or Equal

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- D. Flexible Polyurethane Foam: Single component, gun grade, and low-expanding.
1. Color: White.
  2. Products:
    - a. DAP Products Inc; DRAFTSTOP 812 Foam: [www.dapspecline.com/#sle](http://www.dapspecline.com/#sle).
    - b. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - c. Or Equal
- E. High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0, 32 degrees F, meets requirements for low-temperature flexibility.
1. Color: White.
- F. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multicomponent, 100 percent solids by weight.
  2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
  3. Color: Concrete gray.
  4. Joint Width, Maximum: 1/4 inch.
  5. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
  6. Products:
    - a. Nox-Crete Inc; DynaFlex 502: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - b. W.R. Meadows, Inc; Rezi-Weld Flex: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - c. Or Equal

### 2.7 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
  2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

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3. Open Cell: 40 to 50 percent larger in diameter than joint width.
  4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
  - C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
  - D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
  - E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

#### **3.2 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

#### **3.3 INSTALLATION**

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
  1. Width/depth ratio of 2:1.
  2. Neck dimension no greater than 1/3 of the joint width.

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3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- F. Install bond breaker backing tape where backer rod cannot be used.
- G. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- I. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- J. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
  1. Provide flush joint configuration where indicated.
- K. Tooling of Nonsag Sealants:
  1. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  2. Remove excess sealant from surfaces adjacent to joints.
  3. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- L. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

### 3.4 PLUMBING TRIM

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- A. All escutcheons shall be installed by placing a generous bead of the clear mildew resistant silicone sealant specified in this specification around the inside perimeter of the escutcheon. Immediately the escutcheon shall be placed over the previously prepared opening and securely fastened into place. Do not attempt to remove, smooth or in any way touch the bead formed by the “squeeze”.
- B. After 24 hours have passed, the bead shall be removed by use of a sharp instrument such as a single edged razor blade.

### 3.5 GRAB BARS AND ACCESSORIES AT WET AREAS

- A. After the grab bars and accessories have been installed and their screws are snug, remove the screws completely and fill the holes with the clear mildew resistant silicone sealant specified in this specification. Re-secure the screws taking care not to disturb the bead of silicone “squeeze”.
- B. After 24 hours have passed, any of the bead that exists outside of the flange covers shall be removed by use of a sharp instrument such as a single edged razor blade.

### 3.6 ACOUSTIC SEALANT INSTALLATION

- A. Acoustic Sealant: Install as follows:
  - 1. Place two beads continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

### 3.7 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

### 3.8 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.9 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion.

### 3.10 POST-OCCUPANCY

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- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

**END OF SECTION 07 9200**

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**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this Section.

**1.2 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing and louvers.

**1.3 RELATED REQUIREMENTS**

- A. Section 08 1416 - Flush Wood Doors.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- D. Section 09 9000 - Painting and Coating: Field painting.

**1.4 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

**1.5 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

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- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2019.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2023.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2023.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- J. ASTM C476 - Standard Specification for Grout for Masonry 2023.
- K. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems 1991 (Reapproved 2000).
- L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- M. ASTM E413 - Classification for Rating Sound Insulation 2022.
- N. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames 2016.
- O. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- P. ITS (DIR) - Directory of Listed Products Current Edition.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2023.
- T. SDI 111 - Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components 2009.
- U. UL (DIR) - Online Certifications Directory Current Edition.
- V. SDI 105 - Recommended Erection Instructions for Steel frames.

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- W. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- X. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
- Y. SDI 124 - Maintenance of Standard Steel Doors and Frames.
- Z. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- AA. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- BB. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

### 1.6 SUBMITTALS

- A. Refer to Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Warranty: Executed in Owner's name.

### 1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.
- D. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoor.org/sdi-certified/#sle>.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.
- F. Maintain at project site copies of reference standards relating to installation of products specified.

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- G. Provide a label for each fire rated and sound rated door indicating the testing agencies approval for the required rating. Do not cover or obscure the label in any way.
- H. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
  - 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
    - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.34, R-Value 2.9, including insulated door, thermal-break frame and threshold.
  - 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
    - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

### 1.9 WARRANTY

- A. Refer to Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Special Warranty
  - 1. Provide manufacturer's warranty for defects in material and workmanship for the life of the installation.
  - 2. Include removal of the defective door, hanging, hardware installation, finishing and labeling as required

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Approved Steel Doors and Frames:
    - a. Basis of Design: Steelcraft, an Allegion brand: [www.allegion.com/sle](http://www.allegion.com/sle).

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- b. Ceco Door, an Assa Abloy Group company;: [www.assaabloydss.com](http://www.assaabloydss.com).
  - c. Republic Doors, an Allegion brand: [www.republicdoor.com/#sle](http://www.republicdoor.com/#sle).
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Section 012500.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
- 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  - 4. Door Edge Profile: Manufacturers standard for application indicated.
  - 5. Typical Door Face Sheets: Flush.
  - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
  - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### 2.3 DESIGN CLEARANCES

- A. The clearance between the door and frame head and jambs shall be 1/8" (3.2 mm) in the case of both single swing and pairs of doors.

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- B. The clearance between the meeting edges of pairs of doors shall be 1/8" (3.2 mm) to 1/4" (6.3 mm), for fire rated doors 1/8" (3.2 mm) ± 1/16" (1.6 mm).
- C. The clearance at the bottom shall be 3/8" (9.25 mm) above finish floor, 1/2" (12.7 mm) at doors with Auto Door Bottom seals.
- D. The clearance between the face of the door and door stop shall be 1/16" (1.6 mm) to 1/8" (3.2 mm).
- E. All clearances shall be, unless otherwise specified, subject to a tolerance of ± 1/32" (0.8 mm).

### 2.4 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
  - 1. Wind resistant building components tested to the following windstorm or severe weather performance standards:
    - a. ANSI A250.13
    - b. ASTM E330/E1886/E1996
  - 2. Construction: Each wind resistant building component shall be constructed as detailed in the illustrations that follow. Doors over 3'-0" in width that have an exit device must have a horizontal steel stiffener located at centerline of device. When door height is over 7'-0" and design pressure is over 60 PSF and door has mortise lock (single door) or has an ANSI strike with bolts on inactive leaf of pair, vertical lock edge steel stiffeners must be installed.
  - 3. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  - 4. Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  - 5. Door Thermal Resistance: R-Value of 10.
  - 6. Door Thickness: 1-3/4 inches, nominal.
  - 7. Weatherstripping: Refer to Section 08 7100.
- B. Interior Doors, Non-Fire Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.

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- c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
  3. Door Thickness: 1-3/4 inches, nominal.
- C. Fire-Rated Doors:
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
    - a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
    - b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    - c. Attach fire rating label to each fire rated unit.
  3. Core Material: Vertical steel stiffeners.
  4. Door Thickness: 1-3/4 inches, nominal.
  5. Door Finish: Factory primed and field finished.

### 2.5 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Fully welded.
  1. Wind resistant building components tested to the following windstorm or severe weather performance standards:
    - a. ANSI A250.13
    - b. ASTM E330/E1886/E1996
  2. Frames may also be listed as fire door frames tested in accordance with UL 1 OB or UL 1 OC or ITSIWH. Frames may be fire rated up to and including three hours, except as noted where glass is

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installed in a frame.

3. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
  4. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
  5. Frame Finish: Factory primed and field finished.
  6. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames: Non-Fire Rated: Fully welded type.
1. Frame Profile - Unequal Rabbet profile, standard with manufacturer.
    - a. Series, 0.9 mm (16 gage) thick, closets, bathrooms, interior room areas.
    - b. Series, 1.2 mm (14 gage) thick, with kerf for door seal/gasket for unit entry doors and fire rated frames.
  2. Finish: Factory primed, for field finishing.
    - a. Frames for high humidity areas to be electro galvanized prior to pre-finishing.
- D. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
  2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
  3. Frame Finish: Factory primed and field finished.
  4. Fire Rated Grade: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
  5. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
    - a. Provide units listed and labeled by UL.
    - b. Attach fire rating label to each fire rated unit.
  6. Provide reinforcements shipped loose to project site for hardware application
  7. Casing: Provide a frame without casing retainer clips. Provide frames with nail holes and oval slots (NHOS) only.
    - a. Refer to Interior Design Drawings and Specifications for casings.

### 2.6 SPECIAL FUNCTION HOLLOW METAL FRAMES

- A. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

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- B. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- C. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- D. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- E. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

### 2.7 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

### 2.8 ACCESSORIES

- A. Glazing: As specified in Section 08 8000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 08 7100.
- D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
  - 1. Manufacturers:
    - a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series; \_\_\_\_\_: [www.ITWBuildex.com/#sle](http://www.ITWBuildex.com/#sle).
- E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

### 2.9 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

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- B. Floor Anchors: Floor anchors to be provided at each jamb. Formed from same material as frames, not less than 0.0625 inches thick.
  - 1. Angle clip type, a minimum of 16 gauge, two fasteners per jamb and weld to bottom of each jamb.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

### 2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
  - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
  - 3. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
  - 4. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire- performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
  - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.
- E. Hollow Metal Frames:
  - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

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3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Weld guard boxes to frame at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
9. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
10. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
  - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
  - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
  - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
  - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
11. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
12. Jamb Anchors: Provide number and spacing of anchors as follows:
  - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
    - 1) Provide one anchor for every 30 inches of jamb or fraction thereof.

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- 2) Two anchors per jamb up to 60 inches high.
  - 3) Three anchors per jamb from 60 to 90 inches high.
  - 4) Four anchors per jamb from 90 to 120 inches high.
  - 5) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
- b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
- 1) Three anchors per jamb up to 60 inches high.
  - 2) Four anchors per jamb from 60 to 90 inches high.
  - 3) Five anchors per jamb from 90 to 96 inches high.
  - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
  - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
- c. FEMA 361 Storm Shelters: Provide five wall anchors per jamb, at 4" maximum from each end of door opening height, equally spaced, four wall anchors per head at pairs, 6" maximum from each end of door opening and two wall anchors per head at singles, 6" maximum from each end of opening width.
13. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Section 08 7100 - Door Hardware.
- F. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section 08 7100.
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

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- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### 3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Coat inside of frames to be installed in masonry, to be grouted or where sound deadening is specified, with bituminous coating, prior to installation.

### 3.3 INSTALLATION GENERAL

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 7100.
- F. Comply with glazing installation requirements of Section 08 8000.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.
- I. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

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3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- J. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- K. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### 3.5 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.
- C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

### 3.6 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION 08 1113**

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**SECTION 08 1416  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flush wood doors; fire rated, non-rated, and acoustical.

**1.2 RELATED REQUIREMENTS**

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glass and Glazing.

**1.3 REFERENCE STANDARDS**

- A. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard 2022.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- D. ASTM E413 - Classification for Rating Sound Insulation 2022.
- E. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2023.
- F. AWI (QCP) - Quality Certification Program Current Edition.
- G. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- H. ICC (IBC) - 2018 - International Building Code 2018.
- I. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- L. UL (BMD) - Building Materials Directory current edition.
- M. UL (DIR) - Online Certifications Directory Current Edition.
- N. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

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- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS).
- D. Test Reports: Show compliance with specified requirements for the following:
  - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
  - 2. Certification that the fire door assembly complies with NFPA 252 and UL 10A, UL 10B and UL 10C as applicable.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Warranty, executed in Owner's name.

### 1.5 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than 10 years of documented experience.
  - 1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than 5 years of documented experience.
- D. Provide a label for each fire rated and sound rated door indicating the testing agencies approval for the required rating. Do not cover or obscure the label in any way.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

### 1.7 WARRANTY

- A. See Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
  - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

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### C. Special Warranty

1. Include removal of the defective door, hanging, hardware installation, finishing and labeling as required.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Wood Veneer Faced Doors:

1. Basis of Design: [Masonite.com/architectural/products/cendura-series](http://Masonite.com/architectural/products/cendura-series).
2. Algona: [www.algomahardwoods.com](http://www.algomahardwoods.com)
3. Graham Wood Doors: [www.grahamdoors.com](http://www.grahamdoors.com).
4. Marshfield Door Systems, Inc: [www.marshfielddoors.com](http://www.marshfielddoors.com).

### 2.2 DOORS AND PANELS

#### A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
  - a. Use minimum 1/50-inch thick for wood door face.

#### B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
3. Sound Retardant Doors: Specified STC ratings as indicated on drawings and calculated in accordance with ASTM E 413, tested in accordance with ASTM E 1408. Provide acoustical core for doors to mechanical and electrical rooms and other scheduled locations.
4. Wood veneer facing with factory transparent finish as indicated on drawings.

#### C. Transom Panels: Same construction and finish as door; same performance rating as door.

### 2.3 DOOR AND PANEL CORES

- A. Provide particleboard core complying to ANSI/A208.1 Grade 1-LD-2 bonded to outer stiles and rails, adding to Door Performance, for non-rated and 20 minute rated door core.
- B. Vertical stiles for non-rated and 20 minute rated doors to be an overall 1 3/8 wide after factory trim, bonded to core.

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- C. For rail edges, non-rated and 20 minute rated, provide mill option, softwood, hardwood or engineered lumber meeting NWWDA IS1-A standards, bonded to core
- D. Use six-inch top rail required for listed door closers for non-rated and 20 minute rated doors.
- E. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- F. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

### 2.4 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: White oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical Edges: Same species as face veneer.
  - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
- B. Facing Adhesive: Type I - waterproof.

### 2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
  - 1. Exception: Doors to be field finished.
- G. Provide edge clearances in accordance with the quality standard specified.

### 2.6 FINISHES - WOOD VENEER DOORS

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- A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 12 Polyurethane Water-based.
    - b. Stain: As specified in Drawings and Specifications.
    - c. Sheen: per approved sample.
  - B. Factory finish doors in accordance with approved sample.
  - C. Seal door top edge with transparent wood sealer to match door facing.

### 2.7 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 1113.
- B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
  - 1. Size: As indicated on drawings.
  - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
  - 3. Metal Finish: Match door polyester powder coating.
- C. Glazing: See Section 08 8000.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Door Hardware: See Section 08 7100.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.

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1. Adjust width of non-rated doors by cutting equally on both jamb edges.
  2. Trim maximum of 1/2 inch off bottom edges unless otherwise required.
  3. Trim fire-rated doors in strict compliance with fire rating limitations.
- D. To the greatest extent possible, factory (shop) prepare doors for hardware.
- E. Use machine tools to cut or drill for hardware.
- F. Coordinate installation of doors with installation of frames and hardware.
- G. Coordinate installation of glazing.
- H. Install door louvers plumb and level.

### 3.3 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### 3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

### 3.5 SCHEDULE

- A. Refer to Drawings.
- B. See Door and Frame Schedule appended to this section.

**END OF SECTION 08 1416**

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**SECTION 08 3100  
ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this section.

**1.2 SECTION INCLUDES**

- A. Wall-mounted access units.
- B. Ceiling-mounted access units.

**1.3 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ITS (DIR) - Directory of Listed Products Current Edition.
- C. UL (FRD) - Fire Resistance Directory Current Edition.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; current edition.

**1.4 SUBMITTALS**

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, latching and locking provisions, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Provide Drawings indicating exact position of all access door units.
- D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.
- E. Project Record Documents: Record actual locations of each access unit.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years documented experience.

**1.6 QUALITY ASSURANCE**

- A. Single Source Responsibility: Obtain access door and panel units, and frames for entire Project from 1 source and 1 single manufacturer.

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- B. Size Variations: Obtain Architect's acceptance and approval of manufacturer's standard size units that may vary slightly from sizes indicated on Drawings.
- C. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

### 1.7 WARRANTY

- A. See Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Warrant materials and workmanship against defects after completion and final acceptance of Work.
  - 1. Repair defects, or replace with new materials, faulty materials or workmanship developed during the guarantee period at no expense to Owner.
  - 2. Access Panel Warranty: 1 year from date of shipment.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS:

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Babcock-Davis: [www.babcockdavis.com](http://www.babcockdavis.com)
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Sections 088000.
  - 1. Karp Associates, Inc: [www.karpinc.com](http://www.karpinc.com).
  - 2. J.L. Industries: [www.jlindustries.com](http://www.jlindustries.com) .
  - 3. Nystrom: [www.nystrom.com](http://www.nystrom.com)
  - 4. Milcor, Inc: [www.milcorinc.com](http://www.milcorinc.com).
- C. Substitutions: Refer to Section 012500 - Substitution Procedures.

### 2.2 ACCESS PANELS

- A. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Material: Steel.
  - 2. Style: As indicated on drawings.
  - 3. Style: Exposed frame with door surface flush with frame surface.

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- a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
  - b. Plaster Mounting Criteria: Use plaster bead type frame.
  4. Door Style: Single thickness with rolled or turned in edges.
  5. Frames: 16 gauge, 0.0598 inch, minimum thickness.
  6. Heavy Duty Frames: 14 gauge, 0.0747 inch, minimum thickness.
  7. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
  8. Heavy Duty Single Steel Sheet Door Panels: 14 gauge, 0.0747 inch, minimum thickness.
  9. Double-Skinned Hollow Steel Sheet Door Panels: 16 gauge, 0.059 inch, minimum thickness, on both sides and along each edge.
  10. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.
  11. Insulation: Non-combustible mineral wool or glass fiber.
- B. Non rated flush access doors, Babcock-Davis BN series
1. Door: Fabricate from 14-gauge cold rolled sheet steel.
  2. Frame: Fabricate from 16-gauge cold rolled sheet steel. Provide 1/4 inch mounting holes.
    - a. BNT - All surfaces - 1 inch flange at perimeter.
    - b. BNW - Wallboard surfaces - 22-gauge galvanized drywall bead at perimeter.
    - c. BNP - Plaster surfaces - 22-gauge galvanized plaster bead at perimeter.
    - d. BPT - Stainless Steel - 1 inch flange at perimeter.
  3. Hinge:
    - a. BNT - Concealed pin type, spring loaded to allow for door removal, set to open 175 degrees.
    - b. BNW and BNP - Concealed continuous piano hinge.
    - c. BPT - Pin hinge
  4. Latching/Locking Devices: Screwdriver cam latch - standard.
  5. Finish: Polyester powder coat; Paintable.
    - a. No. 4 Stainless Steel finish at front of house tile, stone, FRP and other selected locations.
  6. Size(s): As indicated.
- C. Non-Insulated Fire Rated Assemblies: Babcock-Davis BU Series. Fire rating as required by applicable code for the fire rated assembly in which they are to be installed.

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1. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
  2. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
  3. Steel Finish: Primed.
  4. Door: 14-gauge cold rolled steel
    - a. Door and frame assembly shall comply with NFPA 80.
  5. Frame: 16-gauge cold rolled steel
    - a. BUT: 1" flange for all surfaces
    - b. BUW: 22-gauge galv. drywall corner bead
    - c. BUP: 22-gauge galv. plaster casing bead
  6. Hinge:
    - a. BUT: Flush continuous piano
    - b. BUP: Concealed pin
    - c. BUW: Concealed pin
  7. Latch: Knurled knob/key operated latch bolt.
  8. Finish: Polyester powder coat; Paintable.
  9. Door/Panel Size: As indicated on the drawings.
  10. Hardware:
    - a. Hinge, Fire-Rated-Units: 175 degree steel hinges with non-removable pin, self closing and self-latching.
    - b. Hinges for Non-Fire-Rated Units: Continuous pivoting rod hinge.
    - c. Handle: Fixed.
    - d. Hinge: Non-Fire-Rated Units: 175 degree steel hinges with removable pin.
    - e. Lock: Screw driver slot for quarter turn cam lock. Provide additional cam locks as required by the Manufacturer to keep the door closed flush.
    - f. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
  11. Gasketing: Extruded neoprene, around perimeter of door panel.
- D. Recessed access panels, Babcock-Davis BR series:

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1. Door: Fabricate from 16-gauge cold rolled sheet steel recessed 5/8" depth pan for in-fill of material to match surrounding surface.
  2. Frame: Fabricate from 16-gauge cold rolled sheet steel of configuration to suit material application.
    - a. BRW- Wallboard surfaces - 22-gauge galvanized drywall bead at perimeter.
    - b. BRP- Plaster surfaces - 22-gauge galvanized plaster bead at perimeter.
    - c. BRA - Acoustical surfaces - no surface frame.
  3. Size: As indicated.
  4. Hinge: Concealed pivoting rod.
  5. Latching: Screwdriver cam latch.
  6. Finish: Paintable powder coat.
- E. Babcock-Davis BRU Series for tiled vertical surfaces.
1. Door: 14-ga bonderized/galvanized steel.
  2. Frame: 16-ga bonderized/galvanized steel.
  3. Hinge: Cabinet type.
  4. Latch: Flush key operated lock.
  5. Finish: None.
- F. GRG Access Doors: Non-hinged, lift-out type ceiling access panel and frame manufactured from glass fiber reinforced gypsum (GFRG)
1. Manufacturers:
    - a. Wind-lock Corp.: Stealth Access Panels; [www.wind-lock.com](http://www.wind-lock.com)
    - b. Stonetex and Distributed by Chicago Metallic Corporation 800-323-7164  
[www.chicagometallic.com](http://www.chicagometallic.com)
    - c. Moonlight Molds, Inc.; [www.moonlightmolds.com](http://www.moonlightmolds.com)
  2. Shell Thickness: 1/8 inch to 3/16 inch
  3. ASTM E84 Fuel/Flame Spread/Smoke Index: 0/0/0; non-combustible.
  4. Installation Materials: As specified in Section 09 2116.
- G. Exterior insulated access panel, Babcock-Davis BXT series
1. Door: Fabricate from 20-gauge galvanized steel, insulated sandwich type construction.

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2. Hinge: Stainless steel continuous piano type.
3. Type No. 304 stainless steel - door only.
4. Frame: Fabricate from 6063-T5 extruded aluminum.
5. Latching/Locking device: 1 or 2 dual acting handles, depending on door size.
6. Lockable handle for exterior only.
7. Flange: 0.080 6063-T5 extruded aluminum 1.25 inch flange.
8. Finish: Paint grip.
9. Insulation: 2 inch thick fiberglass.
10. Gasket: Extruded santoprene.
11. Size: As indicated.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify mechanical and electrical requirements for ceiling or wall access panels.

#### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.
- C. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

#### **3.3 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.
- D. Do not install access doors where frame will extend over different finish materials. Notify Architect prior to commencing work.

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- E. Installation of GRG Access Doors: Install doors using gypsum board screws and gypsum board tape, fill and sanding in same manner as installation of gypsum board ceiling panels as specified in Section 09 2116.

**3.4 ADJUST AND CLEAN**

- A. Adjust panel after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or damaged.

**END OF SECTION 08 3100**

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**SECTION 08 3223  
FOLDING GLAZED WALLS AND DOORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Glazed aluminum folding wall panel systems, top supported.

**1.2 RELATED REQUIREMENTS**

**1.3 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- C. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
- D. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- F. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2023.

**1.4 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide information on dimensions, frame and sill construction, glazing, and hardware.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, and framed opening tolerances.
- D. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

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1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
- B. Installer Qualifications: Company specializing in installation of products of type specified, with not less than three years of documented experience.
  1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site and store in manufacturer's protective cartons until openings are ready for installation.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

### 1.7 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
  1. Maintain this minimum temperature during and 24 hours after installation of sealants.

### 1.8 WARRANTY

- A. See Section 01 7800 - Closeout Procedures and Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## PART 2 PRODUCTS

### 2.1 BASIS OF DESIGN - ALUMINUM PANEL FRAME

- A. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below.
  1. Arcadia, Inc; 10000 Oasis Multi-Fold Door: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).

### 2.2 MANUFACTURERS

- A. Glazed Aluminum Folding Wall Systems:
  1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).

### 2.3 PERFORMANCE REQUIREMENTS

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- A. Performance Requirements: For units mounted in exterior walls and that require weather performance, provide systems that comply with the following:
  - 1. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  - 2. Water Penetration Resistance; Static Pressure: No uncontrolled water entry on interior face when tested in accordance with ASTM E331 at differential pressure of 5.25 lbf/sq ft.
  - 3. Air Leakage: 0.07 to 0.30 cfm/sq ft maximum leakage at 6.27 psf pressure difference, when tested in accordance with ASTM E283/E283M.

### 2.4 DESIGN CRITERIA - EXTERIOR SYSTEMS

- A. Structural Design Criteria Based on Regulatory Requirements: Comply with applicable code criteria for loads, including seismic loads, except as indicated below.
- B. Structural Design Criteria: As indicated on drawings.

### 2.5 SLIDING AND FOLDING GLAZED DOORS AND WALLS

### 2.6 SLIDING AND FOLDING GLAZED DOORS AND WALLS

- A. Glazed Aluminum Folding Wall Panel Systems: Extruded aluminum sliding and fixed wall panel frames, factory fabricated; complete with sill, flashings, and support and anchorage devices.
  - 1. Configuration: Exterior, outward opening, right stacking, with locking swing panel door.
  - 2. Support System: Offset Top Hung.
  - 3. Seals: Rubber, automatically extending from top and bottom rails.
  - 4. Outswing Weather Performance Sill: Low profile saddle type, with sealant, shims and fasteners at necessary locations.
    - a. Finish: To match the panel frame.
    - b. Provide weep holes in sill and drain connections to exterior in accordance with manufacturer's requirements for weather performance indicated.
  - 5. Panel Rail Depth: Manufacturer's standard.
  - 6. Panel Weight: 264 lbs, maximum.
  - 7. Aluminum Frames: Factory finished; manufacturer's standard corner construction; thermally broken.
  - 8. Drainage: Provide drainage to exterior for moisture entering joints and glazing spaces and for condensation occurring within frame construction.
  - 9. Glass Stops: Same material and color as frame.
  - 10. Aluminum Frame Finish: Anodized coating in accordance with AAMA 611.

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- B. Weatherstripping: Manufacturer's standard, continuous and replaceable; provide between exterior doors, panels, frame and track.

### 2.7 FACTORY ASSEMBLY

- A. Factory assemble sliding/folding operable panel frames as single unit, including head, jambs, and bottom sections; provide concealed fasteners.
  - 1. Sizes: Allow for tolerances of rough framed openings, clearances, and shims at perimeter of assemblies.
  - 2. Joints and Corners: Flush, hairline and waterproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 3. Glazing: Factory installed.

### 2.8 ACCESSORIES

- A. Anchors: Hot-dipped galvanized or stainless steel in accordance with project and manufacturer's installation requirements.
- B. Sealant for Setting Sills and End Dams: Elastomeric sealant acceptable to door manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M, Type I.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that openings are ready to receive work and opening dimensions and clearances are as indicated on approved shop drawings.
- B. Verify that overhead structural supports are adequate and deflection is in compliance with manufacturer's installation requirements.

### 3.2 PREPARATION

- A. Prepare opening to permit correct installation of door unit in coordination with air and vapor seal.
- B. Apply two coats of bituminous paint with minimum of 16 mils, 0.016 inch dry film thickness (DFT), or as recommended by coating manufacturer, on concealed aluminum surfaces in contact with cementitious or dissimilar materials.

### 3.3 INSTALLATION

- A. Install assemblies in accordance with manufacturer's instructions.
- B. Install exterior doors in accordance with ASTM E2112.
- C. Attach frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

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- D. Use anchorage devices to securely fasten assembly to adjacent construction without distortion or imposed stresses.
- E. Set exterior sills in full bed of sealant, with end dams and non-blocking sill drainage openings.
- F. Install shims at exterior wall sill locations and ensure water dams are not created and sill weep openings are not blocked due to shim placement and orientation.
- G. Provide sealed end dams at exterior wall locations.
- H. Install perimeter trim and interior closures.

### 3.4 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation from Plumb: 1/16 inch.
- C. Maximum Variation from Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 feet straight edge.

### 3.5 ADJUSTING

- A. Adjust hardware for smooth operation.

### 3.6 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Remove labels and visible markings.
- C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
- D. Upon completion of installation, thoroughly clean door aluminum surfaces in accordance with AAMA 609 & 610.
- E. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

### 3.7 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION 08 3223**

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**SECTION 08 3613  
SECTIONAL DOORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

**1.2 RELATED REQUIREMENTS**

**1.3 REFERENCE STANDARDS**

- A. ITS (DIR) - Directory of Listed Products Current Edition.
- B. UL (DIR) - Online Certifications Directory Current Edition.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Operation Data: Include normal operation, troubleshooting, and adjusting.
- H. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years documented experience.
- C. Comply with applicable code for motor and motor control requirements.



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- D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

### 1.6 WARRANTY

- A. See Section 01 7800 - Closeout Procedures and Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Sectional Doors:
  - 1. Basis of Design: Clopay Building Products; Industrial Series: [www.clopaydoor.com/#sle](http://www.clopaydoor.com/#sle).
  - 2. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).

### 2.2 DEEP RIBBED STEEL DOORS, POLYSTYRENE INSULATED

- A. Door Construction:
  - 1. Panel Sections: 2 inches (52 mm) thick roll formed commercial quality steel panel sections, hot-dip galvanized per ASTM A924/A924M and ASTM A653/A653M, phosphatized and prepainted with primer and baked-on polyester topcoat. Panel faces reinforced with two 1/2 inch (13 mm) deep ribs on 8 inches (200 mm) centers, complemented by six 1/8 inch (3 mm) beads on 2 inches (50 mm) centers. Sections formed to create weathertight tongue and groove meeting rail. Bottom panel section reinforced with continuous 0.050 inch (1.27 mm) aluminum astragal retainer with U-shaped flexible PVC astragal.
  - 2. Door Stiles: Galvanized, primed, and polyester top-coated turn-down steel end stiles; wrap face of panel sections a full 1-3/8 inches (35 mm); 0.049 inch (1.25 mm) minimum thickness up to 14 ft-2 inches (4.32 m), otherwise 0.61 inch (1.55 mm) thickness; engineered for easy hardware attachment through pre-punched holes.
- B. Heavy Duty Door: Clopay Model 524S.
  - 1. Style: Deep ribbed steel polystyrene insulated doors.
  - 2. Steel Backer Cover: Interior pre-painted 30 gauge steel back cover.
  - 3. Maximum Door Size: 26 feet, 2 inches (7.97 m) wide and 24 ft (7.31 m) high.
  - 4. Exterior Steel Skin Thickness: Minimum 24 gauge 0.022 inch (0.56 mm).
  - 5. Stiles: Galvanized, primed, and polyester top-coated turn-down steel end stiles; engineered for easy hardware attachment through pre-punched holes.
  - 6. Astragal: U-shaped flexible PVC in retainer of full-length 0.055 inch (1.4 mm) rigid PVC.

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7. Insulation: 1-3/8 inches thick (35 mm) polystyrene insulation
  8. Thermal resistance (R-value), 6.6 hr sq ft deg F/BTU (1.2 K sq m/W); calculated door section R-value in accordance with DASMA TDS-163.
- C. Windows:
1. Windows: Full-view sections, prepainted to match door finish.
    - a. Glazing: 1/2 inch (13 mm) dual pane insulated glazing.
- D. Finish: Exterior 1 mil (.025 mm) coating; interior 0.5 mil (0.013 mm) coating; color as follows:
1. Clopay ColorBlast®, a two part paint system utilizing Sherwin Williams® Solar reflective Polane Paint system. Sherwin Williams® color number: As indicated on Drawings.
- E. Locking:
1. No lock
- F. Door Drop Safety Device: Provide brackets designed to stop the fall of the door should lift cables fail.
- G. Weatherstripping: Provide complete perimeter seals.
- H. Track:
1. Provide track configuration to maximize headroom available per plans.
  2. 2 inches (50 mm) track designed for 2" diameter rollers. Vertical tracks minimum 0.061 inch (1.55 mm) galvanized steel. Horizontal tracks minimum 0.075 inch (1.91 mm) galvanized steel.
- I. Spring Counterbalance: Torsion spring counterbalance mechanism sized to weight of the door, with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.
1. High Cycle Spring: 100,000 cycles.

### 2.3 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator provided by door manufacturer for door with operational life specified complete with electric motor and factory pre-wired motor controls, starter, gear-reduction unit, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.
1. Solenoid-operated brake.
- B. Disconnect Device: Provide hand-operated disconnect or mechanism for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

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- C. Design operator so motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.
- D. Provide control equipment complying with NEMA ICS1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, AC or DC.
- E. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motor, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (.03m/s), without exceeding nameplate ratings or considering service factor.
  - 1. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- F. Remote Control Station: Provide momentary contact, 3-button control station with push - button controls labeled "Open", "Close" and "Stop".
- G. Provide interior units, fully guarded, surface mounted, heavy-duty type, with general-purpose NEMA ICS 6 enclosure in one of the following types:
  - 1. Enclosure Type: Type 1.
- H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
  - 1. Sensor Edge: Provide each motorized door with an automatic safety sensing edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cord. Sensing edge shall be operated by:
    - a. Electric Fail safe.
  - 2. Photo-electric control: Provide each motorized door with a photo-electric device that will stop and reverse the downward door travel if the light beam is broken or blocked. Device shall be:
    - a. NEMA Type 1.
- I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- J. Radio Controls: Provide 3 button radio transmitter to provide remote open, close, stop functionality.
  - 1. Provide external antenna and coaxial wiring to receiver to enhance radio control reception.
- K. Provide auxiliary chain hoist: for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

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### 2.4 COMPONENTS

- A. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- B. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- C. Head Weatherstripping: EPDM rubber seal, one piece full length.
- D. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- E. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

#### 3.2 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

#### 3.3 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install perimeter trim.

#### 3.4 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

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**3.5 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

**3.6 CLEANING**

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

**3.7 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

**END OF SECTION 08 3613**

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**SECTION 08 3615  
FOUR-FOLD DOOR SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes Four-Fold metal doors with surface mounted tube frames.
- B. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operators.

**1.2 RELATED SECTIONS**

- A. Section 05 5000 - Metal Fabrications: Steel tubes or channels opening frame.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 088000 - Glass and Glazing.

**1.3 REFERENCE STANDARDS**

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- B. DASMA 102 - American National Standard Specifications for Sectional Doors 2018.
- C. NEMA MG 1 - Motors and Generators 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

**1.4 DESIGN / PERFORMANCE REQUIREMENTS**

- A. Wiring Connections: Requirements for electrical characteristics.
  - 1. 230 volts, three phase, 60 Hz.
  - 2. 460 volts, three phase, 60 Hz.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- C. Wind Performance Requirements:
  - 1. Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.

**1.5 SUBMITTALS**

- A. See Section 013300 - Submittal Requirements, for submittal procedures.

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- B. Product Data for each type of product specified consisting of manufacturer's technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.
- C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade. Include weight and loads imposed on structural supports.
- D. Reference list including (5) successful installations of this type of door within the past two (2) years.

### 1.6 QUALITY ASSURANCE

- A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual".
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least 5 years documented experience.
- D. Conform to applicable code for motor and motor control requirements.
- E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified.

### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.
- B. Handle materials carefully to prevent damage.

### 1.8 WARRANTY

- A. See Section 017836 - Warranties and Bonds for warranty requirements.
- B. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

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1. Four-Fold industrial metal doors manufactured by Door Engineering and Manufacturing, 400 Cherry Street, Kasota, MN 56050, (800)-959-1352 or equal products by other manufacturers approved in advance.

a. Series:

- 1) FF300 Series: Glazed

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).
2. Electric Power Door, 522 West 27th Street, Hibbing, MN 55746, 1-800-346-5760, [www.electricpowerdoor.com](http://www.electricpowerdoor.com)

- C. Substitutions: 012500 - Substitution Procedures.

### 2.2 MATERIALS

- A. Steel Tube: ASTM A513 and ASTM A500/A500M
- B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot-rolled steel sheet.
- C. Hardware: Manufacturer's standard components.
- D. Fasteners: Zinc-coated steel.

### 2.3 FOUR-FOLD DOORS

- A. Construction: Door framing shall be minimum 14-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
- B. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.
- C. Factory finish: Door Panels and Tube Frames shall be finished with manufacturer's standard PPG Spectracron epoxy primer and polyurethane top coat.
  1. Frame Color: Refer to Drawings.
  2. Operator and operating hardware shall be powder-coated manufacturer's standard gray.
- D. Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for

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complete installation and operation.

- E. Hinges: Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Fold hinges shall be stainless steel and be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum 3/4" diameter hardened steel.
- F. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16" cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping at sill shall include two 1/16" cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.
- G. Perimeter Weatherstripping: Provide jamb and head weatherstripping of 1/16" cloth-inserted neoprene bulb (or closed cell neoprene).
- H. Vision Panels: Provide 1" insulated Vision Panels of the size, shape and location as noted on the drawings.
  - 1. Glazing: Refer to Section 08 8000 - Glass and Glazing.

### 2.4 OPERATOR

- A. Each half of the opening shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
- B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to freewheeling mode for manual operation.
- C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/230/480 VAC, 60 Hertz operation.
- D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be (Choose One): 120VAC single phase, 208VAC single phase, 208/230VAC 3-phase, 480VAC 3-phase.
  - 1. Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
  - 2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.

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3. If incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor
  4. Enclosures shall be NEMA 4 with disconnect switch.
  5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
  6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
  7. Safety edges: Provide electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
  8. Photo eyes: Provide (1) exterior, jamb mounted, thru-beam type photo eyes, NEMA 4 rated.
  9. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.
- E. Options:
1. (Option) Presence Sensor: Provide (1) interior, overhead mounted, presence sensor.
  2. (Option) Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.
  3. (Option) Safety Loop Detectors: Provide "safety" loop detector to reverse or hold the door open when activated. G.C. to coordinate installation of preformed loop with installer prior concrete being poured.
  4. (Option) Timer Activation Loop Detectors (fire station applications): Provide "pulse on exit type" loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Verify that conditions are satisfactory for installation of electric four fold doors.
- B. Do not proceed with the Work of this Section until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.
- B. Install door and operating equipment complete with necessary hardware, jamb and head weather strips, anchors, inserts, hangers, and equipment supports in accordance with final Shop Drawings,

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manufacturer's instructions, and as specified herein.

- C. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

### 3.3 ADJUSTING AND CLEANING

- A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.
- B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

**END OF SECTION 08 3615**

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**SECTION 08 3616  
BARN (SLIDING) DOOR**

**PART 1 GENERAL**

**1.1 SUMMARY**

A. Barn (sliding) type door, and related hardware.

**1.2 RELATED SECTION**

A. Section 08 14 16 - Flush Wood Doors

**1.3 SUBMITTALS**

A. See Section 01 3300 - Submittal Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions

C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show blocking by others.

D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

E. Warranty Documentation: Submit manufacturer's standard warranty.

**1.4 QUALITY ASSURANCE**

A. Product Options: drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.

B. Source: Obtain sliding aluminum framed doors from single source

C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

**1.5 REFERENCES**

A. ANSI - American National Standards Institute

1. ANSI 156.18 Materials and Finishes

2. ANSI A117.1 Specifications for making buildings and facilities usable by physically handicapped people.

3. BHMA - Builders Hardware Manufacturers Association

4. DHI - Door and Hardware Institute

5. NFPA - National Fire Protection Association

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- a. NFPA 80 - Fire Doors and Windows
- b. NFPA 101 - Life Safety code
- c. NFPA 105 - Smoke and Draft Control Door Assemblies
- d. NFPA 252 - Fire Tests of Doors Assemblies.

### 1.6 PERFORMANCE

- A. Flame spread test ASTM E84. Passed IBC Code 2012 Class A, Class B and Class C.
- B. Barn door acoustical seals are integrated into the wall module connection detail.
- C. Soft self-closing mechanism integrated with top track.

### 1.7 DELIVERY: STORAGE AND PROTECTION

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
  - 1. Store and handle materials in accordance with manufacturer's instructions.
  - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation
  - 3. Store materials in clean, dry area indoors.
  - 4. Protect materials and finish during storage, handling, and installation to prevent damage.

### 1.8 WARRANTY

- A. Provide manufacturer's limited lifetime warranty covering defects in materials and workmanship and limited to repair or replacement of defective product.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Rustica Hardware: [www.RusticaHardware.com](http://www.RusticaHardware.com).
    - a. Modern Box Track Sliding Barn Door.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

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1. Artisan Hardware: [www.artisanhardware.com](http://www.artisanhardware.com). Krown Lab: [www.krownlab.com](http://www.krownlab.com).

C. Substitutions: 012500 - Substitution Procedures.

### 2.2 INTERIOR BARN DOORS

A. Custom Interior Sliding Barn Door: Model : Refer to Section 08 1416 : Each door is made with a wood core for lightweight stability.

B. Door Opening Size: As indicated on Drawings

C. Door Build: Fully Built.

D. Door Configuration: Bi-parting.

E. Finish: Solid Core Wood.

### 2.3 SLIDING BARN DOOR HARDWARE

A. Sliding Door Hardware: Provide complete sets of rails, hangers, supports, bumpers, floor guides, and accessories indicated. Manufacturer shall conform to ANSI/BHMA A156.14.

1. Track: Model: Modern Box Track. Pre-Drilled.

a. The standard track length should be twice the width of the door itself. If needed, note that tracks less than twice the width may prevent the door from opening fully, and tracks longer will allow the door to slide further past the opening.

b. Rated for doors weighing up to 200 lb. to 250 lb. depending upon hanger style.

c. Track Size: Length: TBD .

1) Pre-Drilled holes will have standard 16" on center spacing.

d. Finish: Flat Black.

2. Pull Handles: Qty.: 2 Model: Industring by Rustica Hardware; [www.RusticaHardware.com](http://www.RusticaHardware.com).

a. Handle Finish: Flat Black.

b. Handle Size: TBD

3. Flush Handles: Qty.: 2 Model: Modern Flush by Rustica Hardware.

a. Finish: Flat Black.

b. Handle Size: TBD

B. System to include: Raw steel track with two end caps, Spacer Extenders hanger wall brackets, door bottom guide, stops, mounting, and installation hardware.

1. Floor Guide: Model: Adjustable U Channel.

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**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.
- B. Verify dimensions of wall openings.
- C. Examine surfaces to receive top and bottom guide.
- D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.
- E. Do not begin installation until unacceptable conditions are corrected.
- F. Base of door side to be flush or minimal. Rubber Base acceptable.

**3.2 INSTALLATION**

- A. Install sliding doors in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install sliding doors plumb, level, square, and in proper alignment.
- C. Install sliding doors to close against walls without gaps
- D. Install sliding doors to open and close smoothly.
- E. Anchor sliding doors securely in place to supports.
- F. Install hardware.

**3.3 TRACK INSTALLATION**

- A. Blocking is required at full width/length of top track.
- B. Locate position of mounting holes use following formula:
  - 1.  $1/2" + [\text{Door Height}] + 1 1/2" = \text{Distance from finish floor to mounting hole.}$
- C. Install track centered and level.

**3.4 ADJUSTING**

- A. Adjust sliding doors for proper operation in accordance with manufacturer's instructions
- B. Adjust sliding doors to operate smoothly without binding.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect

**3.5 CLEANING**

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- A. Clean sliding doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage materials or finish.

**3.6 PROTECTION**

- A. Protect installed sliding doors from damage during construction.

**END OF SECTION 08 3616**



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**SECTION 08 4313  
ALUMINUM ENTRANCES AND STOREFRONT SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Aluminum door and frames:
  - 1. Interior aluminum storefront and window frames.
  - 2. Exterior aluminum storefront.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Steel attachment members.
- B. Section 05 5000 - Metal Fabrications: Steel attachment devices.
- C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- E. Section 08 8000 - Glazing: Glass and glazing accessories.
- F. Section 12 2400 - Window Shades: Attachments to framing members.

**1.3 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- G. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- H. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure

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Difference 2015 (Reapproved 2023).

### 1.4 SYSTEM DESCRIPTION

- A. Aluminum entrances and storefront system includes self-supporting, reinforced, tubular aluminum sections, shop fabricated, factory pre-finished, related flashings, anchorage and attachment devices.
- B. System layout shall be as shown on drawings including custom and non-standard configurations.
- C. Door hardware and glazing are specified in other sections.

### 1.5 PERFORMANCE REQUIREMENTS

- A. Design and size exterior components to withstand dead and live loads caused by pressure and suction of wind in accordance with IBC and requirements as shown on Structural Drawings.
- B. Seismic Loads: Design and size exterior components to withstand seismic loads and sway displacement as calculated in accordance with IBC and requirements as shown on Structural Drawings.
- C. Limit mullion windload deflection of  $L/175$  with full recovery of glazing materials, when measured in accordance with ASTM E330.
- D. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
  - 1. System shall not deflect more than  $1/8''$  at the center point, or  $1/16''$  at the center point of a horizontal member, once deadload points have been established.
- E. Thermal Performance – When tested in accordance with AAMA 1503.1 the following results should be attained: U-Maximum .63/CRF – minimum of 59.
- F. Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area as measured in accordance with ANSI/ASTM E283.
- G. Water Resistance: No water leakage when measured in accordance with ASTM E331 with a static test pressure of 8 PSF(383 Pa).
- H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- I. System to provide for expansion and contraction within system components caused by cycling temperatures without causing detrimental affect to system components.
- J. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.

### 1.6 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.

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- B. Product Data: Provide component dimensions; describe components within assembly, anchorage and fasteners, hardware reinforcing and internal drainage details.
- C. Shop Drawings:
  - 1. Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work and expansion and contraction joint location and details.
  - 2. Shop drawings shall be prepared by and stamped by a Professional Engineer, registered in the State of Nevada.
- D. Submit four (4) samples 6 inches in size illustrating pre-finished aluminum surface.

### 1.7 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Nevada.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least 5 years of documented experience.
- D. Perform Work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual and AAMA - Aluminum Curtain Wall Design Guide Manual.
- E. Single Source Responsibility:
  - 1. Obtain entrances, storefronts, ribbon walls, window walls, curtain walls, window systems, and finish through one source from a single manufacturer.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle work of this section in accordance with AAMA - Curtain Wall Manual #10.
- B. Protect pre-finished aluminum surfaces with stripable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

### 1.9 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

### 1.10 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

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### C. Special Warranty

1. The manufacturer of the insulated glass shall warrant and guarantee direct to the Owner each insulating glass unit installed to be free from material obstructions of vision as a result of dust or film formation on the internal glass surfaces caused by failure of the hermetic seal other than glass breakage, and that spacer bars shall not "walk up" into the cavity between the glass lites, for a period of ten years.
2. The manufacturer of units with coated glass shall warrant and guarantee direct to the Owner each unit be free from discoloration, mottling or deteriorating of the coating regardless of loss of insulating glass seal, for a period of ten years.
3. The manufacturer of the laminated glass shall warrant and guarantee direct to the Owner each unit installed to be free from delamination or other defects for a period of ten years.
4. The Contractor shall guarantee glazing occurring on the building to be weather and watertight for a period of five years after date of Substantial Completion.
5. All warranties shall agree to replace the glass F.O.B. project site, including labor, at no cost to the Owner, provided the manufacturer's instructions for protection and maintenance have been adhered to during the warranty period and failure is not due to vandalism or glass breakage caused by external projectiles.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

1. Arcadia, Inc., 2301 E Vernon, Vernon, CA. Telephone 323/269-7300, Fax 323/269-7390.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. U.S. Aluminum Corp.
2. Kawneer Company, Inc.
3. Or Approved Equal

C. Substitutions: 012500 - Product Substitutions.

### 2.2 SWINGING DOORS

A. Basis of Design Products:

B. Exterior Doors:

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1. Arcadia, Inc., WS512 HD Series, Heavy Duty Door 1-3/4".
  - a. Vertical Stiles: 5 inches.
  - b. Top Rail: 5-5/16 inches.
  - c. Bottom Rail: 10-1/2 inches.
  - d. Glazing Stops: Beveled snap-in type for 1" infill.
- C. Interior Doors:
  1. Arcadia, Inc., WS512 Series, Wide Stile Door 1-3/4".
    - a. Vertical Stiles: 5 inches.
    - b. Top Rail: 5-1/8 inches.
    - c. Bottom Rail: 10-1/2 inches.
    - d. Glazing Stops: Beveled snap-in type for 1/4" infill.
  - D. Major portions of the door stiles a nominal .188 inches and glass stops .050 inches thick.
  - E. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A164. Shall be aluminum or steel, providing the steel is properly isolated from aluminum.
  - F. Glass and Glazing: As specified in Section 088000 - Glazing.
    1. Glazing Gasket (compression-type design).
  - G. Extruded aluminum 6063-T5 alloy and temper (ASTM B221-Alloy G.S. 10a T6) with concealed reinforcement at corners.
  - H. Hardware: As specified in Section 08 71 00 - Door Hardware.
    1. Hardware furnished and installed by the door manufacturer, and include the following standard hardware (as selected).
      - a. Weatherstripping: Hard-backed poly pile in door and/or frame. Meeting stile of all pair of doors have a double line hard-backed poly-pile astragal.
      - b. Threshold: Extruded Aluminum with ribbed surface.
      - c. Sill Sweeps: Brush strip (exposed, concealed).
      - d. Pivoting/Hinging: (Center, offset pivot; butt, continuous.)
      - e. Closers: (Overhead concealed, surface, concealed floor.)
      - f. Latches/Strike: (Dead-latch combination, two-point.)

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- g. Latch Handle: (Lever, eurostyle/ w/return, paddle.)
- h. Electric Release: (Offset strike, center hung strike.)
- i. Locks/Strike: (Maximum security hooklock, deadbolt.)
- j. Auxiliary Locks: (Two-point, three-point, flushbolts.)
- k. Cylinders: (Mortise, rim, dummy, thumbturn.)
- l. Panic Devices: (Cross, touch bar, flush mid panel.)
- m. Push/Pulls: (Standard, offset radius, straight radius.)
- n. Cylinder Guard: (Security ring/retainer ring.)
- o. Exit Indicator: (Message panel.)
- p. Transom Decal: (This door to remain . . . )
- q. Door Stop/Holder:

### I. Finishes:

- 1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

### J. Door Fabrication

- 1. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts, with optional MIG weld. Exposed screws not permitted.
- 2. Each door leaf equipped with an adjusting mechanism, located in the top rail near the lock stile.
- 3. Prepare internal reinforcement for door hardware.
- 4. Custom hardware templates and physical hardware must be submitted prior to any fabrication.

## 2.3 EXTERIOR FRAMING FOR INSULATING GLAZING

### A. Basis of Design:

- 1. Arcadia, Inc., TC470 Series, 2-1/4" x 4-1/2" Thermally broken; offset glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1" insulated or laminated glass.

### B. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6).

### C. Framing shall be 2 inch wide by 4-1/2 inch deep. Provide 4 inch frame headers where shown at exterior doors where shown on drawings.

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- D. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- E. Provide manufacturer's standard polyurethane structural thermal barrier within system.
- F. Glass and Glazing: As shown on drawings and as specified in Section 088000 - Glazing.
  - 1. Insulated glazing system shall be designed for maximum glass thicknesses.
  - 2. Glazing Gasket
    - a. Compression-type design, replaceable, molded or extruded, or ethylene propylene diene monomer (EPDM).
    - b. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
- G. Design system for inside glazing with an outside set.
- H. Anchors: Manufacturer's standard aluminum or stainless steel, appropriate for the substrate involved.
- I. Flashing: Aluminum of configuration shown on drawings and finished to match frames.
- J. Finishes:
  - 1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
  - 2. Protection of Finish: Protect exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
  - 3. Touch-Up Materials: As recommended by coating manufacturer for field application.
- K. System Fabrication
  - 1. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
  - 2. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.
  - 3. Fasteners shall be so located as to ensure concealment from view in the final assembly.
  - 4. System shall be internally flashed with weep holes to allow continuous drainage of moisture to exterior face.
  - 5. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
  - 6. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

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### 2.4 INTERIOR FRAMING FOR 1/4" GLAZING

- A. Basis of Design:
  - 1. Arcadia, Inc., AR450 Series, 2" x 4½", Non-Thermal; center glazed, screw spline, shear block, compensating stick or punched opening fabrication for ¼" glass.
- B. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6). Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- C. Glass and Glazing: As shown on drawings and as specified in Section 088000 - Glazing.
  - 1. Flush glazing stops, sized for glazing specified.
  - 2. Glazing Gasket
    - a. Compression-type design, replaceable, molded or extruded, or ethylene propylene diene monomer (EPDM).
    - b. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
- D. Anchors: Manufacturer's standard aluminum or stainless steel, appropriate for the substrate involved.
- E. Finishes:
  - 1. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
  - 2. Protection of Finish: Protect exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
  - 3. Touch-Up Materials: As recommended by coating manufacturer for field application.

### 2.5 SEALANT MATERIALS

- A. Sealant and Backing Materials: As specified in Section 079200 - Joint Sealants.

## PART 3 EXECUTION

### 2.6 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

### 2.7 INSTALLATION

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- A. Install systems in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Prevent galvanic action and other forms of corrosion by isolating metals from direct contact with incompatible surfaces.
- E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and alignment with adjacent work.
- F. Provide thermal isolation where components penetrate or disrupt building insulation.
- G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- H. Install hardware in accordance with manufacturer's instructions using templates provided.
- I. Install glazing in accordance with Section 088000 - Glazing using glazing method required to achieve performance criteria.
  - 1. No "smash glazing" practices are allowed. All field-glazed applications shall be able to be caulked after the glass is set, no exceptions.
- J. Install perimeter sealant in accordance with Section 079200 - Joint Sealants.

### 2.8 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Pre-Testing Conference: Before beginning testing and inspections, conduct conference at Project to comply with requirements of appropriate Division 01 Sections.
- C. Field Testing and Inspections: Owner will engage a qualified independent testing agency to perform field quality control testing and inspections to determine if installed work complies with specified requirements. Contractor to provide powered scaffold, hose, water supply, communication system and manpower to perform tests.
  - 1. Required Attendees:
    - a. Owner.
    - b. Architect.
    - c. All Exterior Finish Consultants, including supervisors.
    - d. General Contractor, including supervisor.

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- e. Installers of adjacent work, including supervisors.
  - f. Testing agency personnel, including supervisors.
  - g. Storefront Manufacturer's technical representative.
2. Minimum Agenda:
- a. Tour areas representative of assemblies to be tested, discuss and evaluate for compliance with Contract Documents.
  - b. Review specified inspection and testing.
  - c. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
3. Reports: Record discussions and decisions, prepare and certify report, and distribute.
- D. Air Infiltration Test:
- 1. Method: ASTM E783.
  - 2. Locations: At locations determined by Architect.
  - 3. Size: Minimum of one structural bay wide by one story tall, including a stack joint or splice at curtain wall areas.
  - 4. Frequency:
    - a. Test 1: At initial installation.
    - b. Test 2: 50 percent completion.
    - c. Test 3: 80 percent completion.
  - 5. Procedure: Test at 1.5 times rate specified under PART 1, but not more than 0.09 cfm/sf (0.03 L/s per sq m) at each location.
- E. Water Spray Test:
- 1. Method: AAMA 501.2. or modified ASTM E1105 (only when not subjected to an artificial pressure differential)
  - 2. Locations: At locations determined by Architect.
  - 3. Size: Minimum of one structural bay wide by one story tall, including a stack joint or splice at curtain wall areas.
  - 4. Frequency:
    - a. Test 1: At initial installation.
    - b. Test 2: 10 percent completion.

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- c. Test 3: 90 percent completion.
- 5. Procedure: Test at rate specified under PART 1 for 15 minutes at each location.
- 6. Reports: Record testing and inspection results and prepare certified reports according to ASTM E575 format.
- F. Re-testing and Re-inspections Due to Failures: Contractor is responsible for expenses incurred, without additional cost to Owner, due to failure of work to pass testing and inspections.
- G. Delegated Engineering Field Inspection: Inspect work, including connection and attachment to building structural frame, for compliance with delegated engineering, and direct deficiencies to be corrected.
  - 1. Certification: Upon resolution of deficiencies, certify work complies with delegated engineering, authorities having jurisdiction, applicable local building codes, specified requirements, and is in keeping with generally accepted engineering practices.
  - 2. Manufacturers Field Inspection: Manufacturers technical representative shall inspect first days work and periodically inspect work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.
- H. Weepage System: Mask weeps and introduce water to interior areas to demonstrate weepage performance.
  - 1. Fill gutters to average  $\frac{3}{4}$  inch height and hold for 30 minutes.
  - 2. No leakage to interior spaces is allowed.

### **2.9 TOLERANCES: CONFORM TO FOLLOWING NON-CUMULATIVE TOLERANCES:**

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
  - 1. Variation for Vertical Members:
    - a. Not more than 1/8 inch in 26 ft.
    - b. Not more than 1/4 inch in 52 ft.
  - 2. Variation for Horizontal Members: Not more than 1/8 inch in 25 ft in any direction.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Offset from Alignment of Members End to End: Not more than 1/32 inch
- D. Gap Between Removable Members: Not more than 1/16 inch, or not more than 1/32 inch at each end of single member.

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E. Variation in Plane: One of following:

1. Not more than 1/16 inch in 10 ft at any location.
2. Not more than 1/8 inch over entire face or area.

F. Sealant joint width between Mullions and adjacent construction: minimum of 1/4 inch.

**2.10 ADJUSTING**

A. Adjust operating hardware for smooth operation.

**2.11 CLEANING**

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

**2.12 PROTECTION OF FINISHED WORK**

A. Protect finished Work from damage with padding or rigid board.

**END OF SECTION 08 4313**

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**SECTION 08 6223  
TUBULAR SKYLIGHTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

**1.2 RELATED REQUIREMENTS**

- A. Section 07 5419 - PVC Thermoplastic Single-Ply Roofing - Carlisle
- B. Section 07 6200 - Sheet Metal Flashing and Trim
- C. Section 07 7200 - Roof Accessories: Roof Curbs

**1.3 REFERENCE STANDARDS**

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2022.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- F. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference 2000 (Reapproved 2016).
- G. FM Standard 4431 - The Approval Standard for Skylights.
- H. IBC Section 2606.7.2 – Installation – Diffuser Fall Out Test (Devised by PE); 2018.

**1.4 COORDINATION**

- A. Coordinate dimensions, locations, and details of skylight curbs specified in Section 07 7200 - Roof Accessories, with tubular unit skylight curb cap flashings. Verify requirements for roofing system terminations.
- B. Coordinate tubular unit skylight interior termination locations with structural layout, ceiling grid layouts, and other ceiling-mounted items.

**1.5 SUBMITTALS**

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- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.
  - 5. ICC-ES evaluation report.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories. Include weight of assembly.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than 20 years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years documented experience.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

### 1.8 FIELD CONDITIONS

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- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### 1.9 WARRANTY

- A. See Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Skylights: Manufacturer's standard warranty for 10 years.
- C. Electrical Parts: Manufacturer's standard warranty for three years, unless otherwise indicated.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Solatube International, Inc, Open Ceiling with PrisMatic diffuser and Daylight Dimmer: [www.solatube.com/sle](http://www.solatube.com/sle).
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. Tubular Skylight Inc: [www.tubular-skylight.com](http://www.tubular-skylight.com).
  - 2. Velux America, Inc; SUN TUNNEL: [www.veluxusa.com](http://www.veluxusa.com).
- C. Substitutions: 012500 - Substitution Procedures.

### 2.2 TUBULAR DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
- B. Brighten Up Series: Solatube Model 160 DS, 10 Inch (250 mm) Daylighting System.
  - 1. Model:
    - a. Solatube Model 160 DS used for daylighting systems with suspended or hard ceilings. AAMA Type TDDCC.
  - 2. Capture Zone:
    - a. Domes:

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- 1) Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
    - (a) Outer Dome Glazing: Type DA, 0.125 inch (3 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
    - (b) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
    - (c) Optional Shock Inner Dome Glazing: Type DAI, 0.115 inch (2.9 mm) minimum thickness classified as CC1 material. High impact injection molded acrylic required for high velocity wind zones.
    - (d) LightTracker Reflector, made of aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in the dome to capture lo
  - 2) Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
  - 3) Dome Seal: Polyethylene foam seal, black, 0.13 inch (3.2 mm) thick by 10.73 (272.5 mm) diameter, 2 PCF polyethylene foam.
- b. Dome Options:
- 1) Dome Edge Protection Band: Type PB, for fire rated Class A, B or C roof applications. Aluminumized steel nominal thickness of 0.028 inches (0.7 mm).
3. Flashings:
- a. Roof Flashing Base:
- 1) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A653/A653M or ASTM A463/A463M or ASTM A792/A792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.
    - (a) Base Flat: Flat Type F4, no pitch 4 inches (102 mm) high.
- b. Flashing Options:
- 1) Flashing Insulator: Type FI, thermal isolation material for use under flashing.
  - 2) Metal Roof Flashing Kit: Type MR, includes Butyl tape, flashing screws, speed nuts, corner washers and polyurethane sealant.
  - 3) Roof Flashing Turret Extensions: Provide manufacturer's standard extensions as required.
4. Transfer Zone:
- a. Extension Tubes: Aluminum sheet, thickness 0.015 inch (0.4 mm).



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- 1) Reflective Tubes:
  - (a) Reflective angle adapter tube (standard Top and Bottom Tubes), providing up to a 30-degree angle adjustment.
  - (b) Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.
  - (c) Interior Finish: Spectralight Infinity with Cool Tube Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
- 2) Extension Tube Options
  - (a) Extension Tube Angle Adapter: Provide manufacturer's standard adapters for applications requiring:
    - (1) Type A1 one 0 to 90 degree extension tube angle adapter.
    - (2) Type A2 two 0 to 90 degree extension tube angle adapters.
  - (b) Severe Climate Glazing: Type SCG PET GAG plastic glazing to minimize potential for condensation and heat loss. Nominal thickness 0.039 inches (0.99 mm).
  - (c) Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required.
  - (d) Thermal Insulation Panel: Type TIP, high-performance dual-glazed, tube insulation system.
5. Delivery Zone:
  - a. Ceiling Ring: Injection molded impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).
  - b. Ceiling Ring Seal: Polyethylene foam seal, white, 0.25 inch (6.4 mm) wide by 0.19 inch (4.8 mm) high, 2 PCF polyethylene foam with low-tack pressure sensitive adhesive.
  - c. Upper glazing: PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. The nominal thickness is 0.039 inches (0.99 mm).
    - 1) Natural Effect Lens: Type LN.
  - d. Round Diffusers/Decorative Fixtures: Dual Glazed Diffuser Assembly.
    - 1) Lower glazing with integral injection molded acrylic Dress Ring classified as CC2 material. Nominal thickness is 0.110 inches (2.8 mm)
      - (a) Classic OptiView (Fresnel Lens) Diffuser: Type L1, molded polycarbonate plastic classified as CC1 material, nominal thickness 0.022 inches (0.61 mm) with injection molded acrylic Diffuser Trim Ring.

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- e. Square Diffuser Assemblies for Tubes Penetrating Ceilings: Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube 10 inches by 10 inches (254 mm by 254 mm) square diffuser opening.
  - 1) Square JustFrost Decorative Fixture: Type L9, frosted acrylic plastic lens classified as CC2 material (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners.
- 6. Delivery Zone Options
  - a. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use: Provided with dimmer switch and cable.
    - 1) Daylight Dimmer: Type D Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02. Provided with dimmer switch and cable.
- 7. Accessories
  - a. Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer. Note: A maximum of 10 units can be connected to one switch. For use with Daylight Dimmer, Type D, only.
  - b. Cable: Type CA, Two conductor, 22 gauge, low voltage cable (500 ft.) for multiple unit DC connections. For use with Daylight Dimmer, Type D, only when aggregate circuit runs do not exceed 200 feet (60.96 m).
  - c. All Skylights to have Daylight Dimmers to be installed.

### 2.3 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
  - 1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).
  - 2. Performance Grade (PG): Equivalent to or greater than specified design pressure.
- B. Design Pressure (DP): In accordance with applicable codes.
- C. No permanent deflection in excess of 0.2 percent of span.
- D. Air Leakage: 0.30 cfm/sq ft maximum leakage for tubular skylight unit when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.
- E. Water Resistance: No uncontrolled water leakage at 6.27 psf pressure differential with water rate of 5 gallons/h/sf, when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.
- F. Performance Grade (Primary Designator): TDDCC/TDDOC-PG150.
  - 1. Design Pressure (DP): +300/-150 psf (+14.4/-7.2 kPa).

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2. Water Test Pressure: 15 psf (0.72 kPa) with no leakage at 5 gallons per minute spray rate.
  3. Air Leakage Rate: 0.30 cfm/ft<sup>2</sup> maximum.
- G. Performance Class and Grade (Primary Designator) CW-PG110.
1. Design Pressure (DP): +200/-110 psf (+9.58/-5.27 kPa).
  2. Water Test Pressure: 15 psf (0.72 kPa) with no leakage at 5 gallons per minute spray rate.
  3. Canadian Air Infiltration/Exfiltration Rating: A2. (1.5 L/s/m<sup>2</sup> maximum)
- H. Daylighting: Provide daylighting photometric performance comparable to basis of design product at layout indicated, based upon daylighting profile of March 21, 9:00 am local time, at Project location by simulation in accordance with IESNA guidelines.
- I. Air Infiltration: Maximum air leakage through unit of 0.30 cfm/sq. ft. of fixed area as determined according to ASTM E283 at a static-air-pressure differential of 1.57 lbf/sq. ft.
- J. Water Penetration under Static Pressure: No evidence of water penetration through unit when tested according to ASTM E331 at a static-air-pressure differential of 15 lbf/sq. ft.
- K. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing meeting NAFS and identical to specimens tested for fire-exposure behavior in accordance with test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Self-Ignition Temperature: 650 deg F or more for plastic glazing in thickness indicated when tested per ASTM D1929.
  2. Smoke-Production Characteristics: Comply with either requirement below:
    - a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic glazing in manner indicated for application.
    - b. Smoke Density: 75 or less when tested per ASTM D2843 on plastic glazing in thickness indicated for application.
  3. Burning Characteristics: Tested and labeled in accordance with ASTM D635.
    - a. Plastic Glazing for Domes: Acrylic Class CC2.
- L. Fire Ratings for Roof Assemblies with Fire Classifications: Tubular unit skylight with dome edge protection band tested in accordance with ASTM E108 and listed as passing Burning Brand test with target classification of Class B
- M. Energy Performance with Energy Kit Installed:
1. Thermal Transmittance: NFRC 100 maximum U-factor:
    - a. 10 inch Units: 0.55 Btu/hr\*ft<sup>2</sup>\*deg F

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2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC:
  - a. 10 inch Units: 0.28.

### 2.4 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel or forming steel.
- B. Aluminum Sheet: Flat sheet complying with ASTM B209/B209M.
- C. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil dry film thickness per coating.
- D. Joint Sealants: As specified in Section 07 9200 - Joint Sealants.
- E. Mastic Sealants: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- F. Roofing Cement: ASTM D4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

### 2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Galvanized Steel Sheet:
  1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
    - a. Color and Gloss: Neutral gray.

### 2.6 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer
- C. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

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- B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Coordinate requirements for power supply, conduit and wiring.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install tubular unit skylights in accordance with manufacturer's written instructions and approved shop drawings. Coordinate installation of units with installation of substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that finished installation is weather tight.
  - 1. Anchor tubular unit skylights securely to supporting substrates.
- B. Install tubular unit skylight curb counter flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
  - 1. Set roof assembly flashing in continuous bead of sealant.
- C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by tubular unit skylight manufacturer.
- D. Align device free of warp or twist, maintain dimensional tolerances.
- E. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.
- F. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.
- G. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

### 3.4 CLEANING AND PROTECTION

- A. Clean exposed tubular unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Replace glazing that has been damaged during construction period.

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- C. Protect tubular unit skylight surfaces from contact with contaminating substances resulting from construction operations.
- D. Protect installed products until completion of project.
- E. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION 08 6223**

**SECTION 08 7100**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Door hardware, including electric hardware.
  - 2. Storefront and entrance door hardware.
  - 3. Battery-powered electronic credential access control locks and panic hardware lever trim.
  - 4. Power supplies for electric hardware.
  - 5. Remote button release hardware.
  - 6. Door position switches.
  - 7. Padlocks.
  - 8. Cylinders for doors fabricated with locking hardware.
- B. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
  - 1. Windows.
  - 2. Cabinets, including open wall shelving and locks.
  - 3. Signs.
  - 4. Toilet accessories, including grab bars.
  - 5. Installation.
  - 6. Rough hardware.
  - 7. Conduit, junction boxes & wiring.
  - 8. Folding partitions, except cylinders where detailed
  - 9. Sliding aluminum doors, except cylinders where detailed.
  - 10. Access doors and panels, except cylinders where detailed.
  - 11. Corner Guards.
  - 12. Welded steel gates and supports.

**1.2 RELATED DIVISIONS:**

- A. Division 07 – sealant at exterior thresholds
- B. Division 08 – metal doors and frames, interior aluminum frames, wood doors, integrated security systems, specialty doors, storefront and glazed curtainwall systems.
- C. Division 10 – operable partitions
- D. Division 21 – fire and life safety systems
- E. Division 28 – security access systems

**1.3 REFERENCES:**

- A. Use date of standard in effect as of Bid date.
  - 1. American National Standards Institute
    - a. ANSI 156.18 – Materials and Finishes.
    - b. ICC/ANSI A117.1 - 2009 – Specifications for making buildings and facilities usable by physically handicapped people
    - c. ADA – Americans with Disabilities Act of 1990
    - d. BHMA – Builders Hardware Manufacturers Association
    - e. DHI – Door and Hardware Institute
    - f. NFPA – National Fire Protection Association
      - 1) NFPA 80 2013 Edition – Standard for Fire Doors and Other Opening Protectives.
      - 2) NFPA 105 – Smoke and Draft Control Door Assemblies
      - 3) NFPA 252 – Fire Tests of Door Assemblies
    - g. UL – Underwriters Laboratories

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- 1) UL10C – Positive Pressure Fire Tests of Door Assemblies.
- 2) UL 305 – Panic Hardware
- h. WHI – Warnock Hersey Incorporated
- i. Local applicable codes
- j. SDI – Steel Door Institute
- k. WI – Woodwork Institute
- l. AWI – Architectural Woodwork Institute
- m. NAAMM – National Association of Architectural Metal Manufacturers

- B. Abbreviations
1. Manufacturers: see table at 2.1.A of this section
  2. Finishes: see 2.7 of this section.

### 1.4 SUBMITTALS SUBSTITUTIONS

- A. SUBMITTALS: Submit (1) Electronic copy of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity and finish of hardware items.
  2. Use BHMA Finish codes per ANSI A156.18.
  3. Name, part number and manufacturer of each item.
  4. Fastenings and other pertinent information.
  5. Location of hardware set coordinated with floor plans and door schedule.
  6. Explanation of abbreviations, symbols, and codes contained in schedule.
  7. Mounting locations for hardware.
  8. Door and frame sizes, materials and degrees of swing.
  9. List of manufacturers used and their nearest representative with address and phone number.
  10. Catalog cuts.
  11. Point-to-point wiring diagrams.
  12. Manufacturer’s technical data and installation instructions for electronic hardware.
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C. Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

### 1.5 QUALITY ASSURANCE:

- A. Qualifications:
1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
    - a. Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.



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- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.
- F. Pre-Installation Meetings: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware and door closers in the meetings. Convene prior to commencement of related work.

### 1.6 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
  - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

### 1.7 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
  - 1. Location of embedded and attached items to concrete.
  - 2. Location of wall-mounted hardware, including wall stops.
  - 3. Location of finish floor materials and floor-mounted hardware.
  - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
  - 5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
  - 6. Coordinate: low-voltage power supply locations.
  - 7. Coordinate: back-up power for doors with automatic operators.
  - 8. Coordinate: flush top rails of doors at out-swinging exteriors, and throughout where adhesive-mounted seals occur.
  - 9. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

### 1.8 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.

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- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:

1.	Locksets:	Three years
2.	Extra Heavy Duty Cylindrical Lock:	Seven years
3.	Exit Devices:	Three years mechanical One year electrical
4.	Closers:	Twenty-five years mechanical Two years electrical
5.	Hinges:	One year
6.	Other Hardware	Two years

**1.9 COMMISSIONING:**

- A. Conduct these tests prior to request for certificate of substantial completion:
  - 1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
  - 2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.

**1.10 PRODUCTS:**

A.	Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.	
<b>ITEM:</b>	<b>MANUFACTURER:</b>	<b>ACCEPTABLE ALTERNATE:</b>
Hinges	(HAG) Hager	Stanley, Ives
Continuous Hinges	(IVE) Ives	Pemko, Select
Pivots	(IVE) Ives	Rixson
Key System	(SCH) Schlage	Owner Standard
Mechanical Locks	(SCH) Schlage	Best
Exit Devices	(VON) Von Duprin	Stanley
Closers	(LCN) LCN	Stanley
Auto Flush Bolts	(IVE) Ives	Don Jo
Coordinators	(IVE) Ives	Don Jo
Silencers	(IVE) Ives	Don Jo
Push & Pull Plates	(IVE) Ives	Don Jo
Kickplates	(IVE) Ives	Don Jo
Stops & Holders	(IVE) Ives	Don Jo
Thresholds	(RE) Reese	Reese
Seals & Bottoms	(RE) Reese	Reese
Key Cabinets	(LUN) Lund	TelKee
Aluminum Door Locks	(ADA) Adams Rite	None

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A.	Manufacturers and their abbreviations used in this schedule:
ADA	Adams Rite
IVE	H. B. Ives
LCN	LCN Closers
KAB	Kaba
SCH	Schlage Lock Company
VON	Von Duprin
ER	ero International

- A. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

**PART 2 - PRODUCTS**

**2.1 HINGING METHODS:**

- A. Drawings typically depict doors at 90 degrees. Doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer’s published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer’s standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
  - 1. Out-swinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
  - 2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
- D. Continuous Hinges:
  - 1. Geared-type aluminum.
    - a. Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
    - b. If units are used at storefront openings, color-coordinate hinge finish with storefront color. Custom anodizing and custom powdercoat finishes subject to Architect approval.
    - c. Pinned steel/stainless steel type: continuous stainless steel, 0.25-inch diameter stainless-steel hinge pin.
      - 1) Use engineered application-specific wide-throw units as needed to provide maximum swing degree of swing, advise architect if required width exceeds 8 inches.

**2.2 LOCKSETS, LATCHSETS, DEADBOLTS:**

- A. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.
  - 1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
  - 2. Locking Spindle: stainless steel, integrated spring and spindle design.
  - 3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
  - 4. Latchbolt: solid steel.
  - 5. Backset: 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
  - 6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.
  - 7. Electric operation: Manufacturer-installed continuous duty solenoid.
  - 8. Strikes: 16 gage curved steel, bronze or brass with 1.00 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
  - 9. Lock Series and Design: Schlage D series, “Rhodes” design.
  - 10. Certifications:

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- a. ANSI A156.2, 1994, Series 4000, Grade 1.
- b. UL listed for A label and lesser class single doors up to 4 feet x 8 feet.
- c. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per IBC 2018.
- d. Accepted substitutions: Best 9K3 Series

### 2.3 EXIT DEVICES / PANIC HARDWARE

#### A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per IBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.

#### B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging.
2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.
4. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.
5. Impact recessed devices: 1.25 inch projection when push-pad is depressed. Sloped metal end caps to deflect carts, etc. No pinch points to catch skin between touchbar and door.
6. Delayed Egress Devices: Function achieved within single exit device component, including latch, delayed locking device, request-to-exit switch, nuisance alarm, remote alarm, key switch, indicator lamp, relay, internal horn, door position input, external inhibit input plus fire alarm input. NFPA 101 "Special Locking Arrangement" compliant.
7. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
8. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
9. Accepted substitutions: Stanley FL2100 Series

### 2.4 CLOSERS

#### A. Surface Closers: 4050 Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

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5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
  - a. Accepted substitutions: Stanley CLD 4551

### 2.5 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework or other hardware.
  1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
- E. Thresholds: As scheduled and per details. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
  1. Saddle thresholds: 0.125 inches minimum thickness.
  2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
  3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
  4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
  5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
  6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
  7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- F. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.
- G. Wall- & Floor-mounted electromagnetic door holders: LCN's SEM series or approved equivalent. Incorporate into U.L. listed fire & life-safety system, doors release to allow closure and latching when door's zone is in alarm state. Use minimum projection required to allow door to open as widely as allowed by wall conditions and projection of door hardware.

### 2.6 FINISH:

- A. Generally: BHMA 626 Satin Chromium
  1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

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### 2.7 KEYING REQUIREMENTS:

- A. Key System: Schlage Everest patented keyway, small format interchangeable core. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner to determine system keyway(s) and structure and keybow styles, furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
  - 1. New factory registered master key system.
  - 2. Construction keying: Disposable SFIC Cores
  - 3. Owner will install permanent cylinders/cores.
- B. Interchangeable Cores: furnish utility patented, 7-pin solid brass construction.
- C. Locksets and cores: keyed at factory of lock manufacturer where permanent records are maintained.
- D. Permanent keys and cores: use secured shipment direct from point of origination to Owner.
  - 1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
  - 2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
- E. Bitting List: use secured shipment direct from point of origination to Owners upon completion.

### PART 3 - EXECUTION

#### 3.1 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

#### 3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
  - 1. Notify Architect of code conflicts before ordering material.
  - 2. Locate latching hardware between 34 inches to 44 inches above the finished floor
  - 3. Locate panic hardware between 36 inches to 44 inches above the finished floor.
  - 4. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

#### 3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
  - 1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
  - 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
  - 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
  - 4. Replace fasteners damaged by power-driven tools.

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- B. Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

### 3.4 ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
  - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
  - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
    - a. Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
    - b. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
    - c. Adjust door closers per 1.9 this section.
- B. Fire-rated doors:
  - 1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
  - 2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
  - 3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- C. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
  - 1. Has re-adjusted hardware.
  - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
  - 3. Has identified items that have deteriorated or failed.
  - 4. Has submitted written report identifying problems.

### 3.5 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

### 3.6 PROTECTION/CLEANING:


- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

### 3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

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**3.8 DOOR HARDWARE SCHEDULE**

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Hardware Schedule:  indicates hyperlink to Hardware Product information:

**HW SET: 01**

101

Provide each SGL door(s) with the following:











QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	EXIT DEVICE	AX-98-L-NL-06		626	VON
1	EA	FSIC RIM C LINDER	20-079		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE		630	VON
1	EA	SURFACE CLOSER	4050A-SCNS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA OMIT WHERE SHELTERED		AA	ER
1	SET	WEATHERSTRIP	50AA-S HEAD AND JAMBS		AA	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER
1	EA	DOOR CONTACT	7766		628	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 01.1 - RATED**

138                      140B

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	AX-98-L-F-996L-06		626	VON
1	EA	FSIC RIM C LINDER	20-079		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE		630	VON
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR CONTACT	7766		628	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS



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**HW SET: 02**

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD		628	IVE
1	EA	PUSH/PULL BAR	9190HD-12"-NO		630	IVE
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18		689	LCN
1	EA	WALL STOP	WS406/407CCV		626	IVE

SEALS B DOOR MANUFACTURER

**HW SET: 03**

127

Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	SET	CONST LATCHING BOLT	FB51/61 AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D		626	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	COORDINATOR	COR-2 COMPLETE		628	IVE
2	EA	SURFACE CLOSER	4050		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA OMIT WHERE SHELTERED		AA	ER
1	SET	WEATHERSTRIP	50AA-S HEAD AND JAMBS		AA	ER
2	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

**HW SET: 03.1**

126                      134                      135                      150

Provide each PR door(s) with the following:











QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	SET	CONST LATCHING BOLT	FB51/61 AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D		626	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	COORDINATOR	COR-2 COMPLETE		628	IVE
2	EA	SURFACE CLOSER	4050-H		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS441/444 AS REQ'D		626	IVE
2	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

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**HW SET: 03.2**

145                      149













Provide each PR door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	SET	CONST LATCHING BOLT	FB51/61 AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D		626	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	COORDINATOR	COR-2 COMPLETE		628	IVE
1	EA	SURFACE CLOSER	4050-H		689	LCN
1	EA	SURFACE CLOSER	4050-H-SCNS		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS441/444 AS REQ'D		626	IVE
2	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

**HW SET: 03.3**

152

Provide each PR door(s) with the following:





QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	SET	CONST LATCHING BOLT	FB51/61 AS REQ'D		630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D		626	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE		630	VON
1	EA	COORDINATOR	COR-2 COMPLETE		628	IVE
2	EA	SURFACE CLOSER	4050		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA OMIT WHERE SHELTERED		AA	ER
1	SET	WEATHERSTRIP	50AA-S HEAD AND JAMBS		AA	ER
2	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

CARD READER AND WIRING B OTHERS

**HW SET: 04**







148

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	AX-98-L-F-996L-06		626	VON
1	EA	FSIC RIM C LINDER	20-079		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE		630	VON

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1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

CARD READER AND WIRING B OTHERS

**HW SET: 04.1**

138A                      138B                      140A









Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	AX-98-LBE-F-996L-06		626	VON
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER

**HW SET: 04.2**

148A






Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	AX-98-LBE-F-996L-06		626	VON
1	EA	FSIC RIM C LINDER	20-079		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	SURFACE CLOSER	4050A-SCNS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

**HW SET: 05**

143

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	LOCK GUARD	LG10		630	IVE
1	EA	SURFACE CLOSER	4050-H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE

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1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	RAIN DRIP	142AA OMIT WHERE SHELTERED		AA	ER
1	SET	WEATHERSTRIP	50AA-S HEAD AND JAMBS		AA	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

**HW SET: 05.1**

145A

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	LOCK GUARD	LG10		630	IVE
1	EA	SURFACE CLOSER	4050-H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	RAIN DRIP	142AA OMIT WHERE SHELTERED		AA	ER
1	SET	WEATHERSTRIP	50AA-S HEAD AND JAMBS		AA	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER

CARD READER AND WIRING B OTHERS

**HW SET: 06**

142

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	LOCK GUARD	LG10		630	IVE
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER
1	EA	THRESHOLD	AS DETAILED		A	ER
1	EA	DOOR CONTACT	679-05		BLK	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 06.1**

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124

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE
1	EA	DOOR CONTACT	679-05		BLK	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 06.2**

101A                    107                    123

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	LOCK GUARD	LG10		630	IVE
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE
1	EA	DOOR CONTACT	679-05		BLK	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 06.3**

136

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE

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1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE
1	EA	DOOR CONTACT	679-05		BLK	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 06.4**

151A

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	VANDL STOREROOM LOCK	ND96BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	ELECTRIC STRIKE	6400 FSE		630	VON
1	EA	LOCK GUARD	LG10		630	IVE
1	EA	SURFACE CLOSER	4050-H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE
1	EA	DOOR CONTACT	679-05		BLK	SCE
1	EA	POWER SUPPL	PS902			VON

CARD READER AND WIRING B OTHERS

**HW SET: 07**

144

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER

**HW SET: 07.1**

151

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER






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**HW SET: 07.2**

121







Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

**HW SET: 07.3**

147






Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER

**HW SET: 08**

125






Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

**HW SET: 08.1**

122

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

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**HW SET: 08.2**

139A

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR BOTTOM	364AA		AA	ER

**HW SET: 09**

141

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	ENTRANCE LOCK	ND53BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

**HW SET: 11**

108	111	112	115	116	119
120	128	131	132	146	

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PRIVAC LOCK	ND40S RHO		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	COAT AND HAT HOOK	571		626	IVE
3	EA	SILENCER	SR64/65 AS REQ'D		GR	IVE

**HW SET: 12**

109	110	113	114	117	118
129	130	133			








Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
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3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	ENTRANCE LOCK	ND53BDC RHO		626	SCH
1	EA	FSIC CORE	26-094		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR BOTTOM	364AA		AA	ER

**HW SET: 13**

102







Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4050-H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER

**HW SET: 13.1**

150A








Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4050-H-SCNS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER

**HW SET: 14**

103                      104

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	3CB1 SH 4.5 X 4.5 NRP		630	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4050		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	PERIMETER SEALS	188 HEAD AND JAMBS		BK	ER
1	EA	DOOR SWEEP	39A		A	ER

**City of Sparks - Fire Station #6**

**HW SET: 15**

103A                    104A                    142A                    142B                    142C

Provide each FLD door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	C LINDER	AS REQUIRED	626	SCH
	EA	NOTE	BALANCE OF HARDWARE B FOLDING DOOR MANUFACTURER		B/O

**HW SET: 15.1**

142D                    142E                    142F

Provide each RU door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	HARDWARE B ROLL UP DOOR MANUFACTURER		B/O

**HW SET: 16**

106

Provide each SGL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	ALL HARDWARE B GATE MFGR		B/O

**HW SET: 19**

105A                    139

Provide each SL door(s) with the following:

QT		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	NOTE	ALL HARDWARE B SLIDING DOOR MANUFACTURER		B/O

**END OF SECTION**

**City of Sparks - Fire Station #6**

**SECTION 08 8000  
GLASS AND GLAZING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Backpainted colored glass, referred to as backpainted or backcoated glass.
- D. High performance insulated translucent glazing units.
- E. Fire-Rated Glazing.
- F. Glazing compounds and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers.
- B. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08 32 00 - Sliding Glass Doors: Glazing furnished by door manufacturer.
- F. Section 08 36 15 - Four-Fold Door Systems:
- G. Section 08 43 13 - Aluminum Entrances and Storefront Systems: Glazing furnished as part of storefront assembly.

**1.3 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
- C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- F. ASTM C1036 - Standard Specification for Flat Glass; 2011.

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- G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- M. GANA (GM) - GANA Glazing Manual; 2009.
- N. GANA (SM) - GANA Sealant Manual; 2008.
- O. ICC (IBC)-2012 - International Building Code; 2012.
- P. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).
- Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
- R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
- S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

### 1.4 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit 4 samples 12 by 12 inch in size of glass units, showing coloration and design.
- E. Samples: Submit 12 inch long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

### Glass and Glazing - 08 8000

Bid Set - Jan 04, 2024

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## City of Sparks - Fire Station #6

2. Extra Insulating Glass Units: One of each glass size and each glass type.

### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years documented experience.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

### 1.6 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### 1.7 WARRANTY

- A. See Section 01 78 36 - Warranties and Bonds, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Float Glass Manufacturers:
  1. Guardian Industries Corp: [www.sunguardglass.com](http://www.sunguardglass.com).
  2. PPG Industries, Inc: [www.ppgideascales.com](http://www.ppgideascales.com).
- B. Backpainted glass Manufacturers:
  1. Basis of Design: Gardner Glass Products, Inc., North Wilkesboro, NC, (800)334-7267, [www.dreamwalls.com](http://www.dreamwalls.com).
  2. Element Designs Inc.: [www.element-designs.com](http://www.element-designs.com).
- C. Translucent Glass Fabricators:
  1. Basis of Design: Okalux GmbH, "Schott North America, Inc."
  2. Advanced Glazings Limited, "Solera".

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### D. Fire Rated Safety-Rated Ceramic Manufacturers.

1. FireLite Plus® as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com, web site <http://www.fireglass.com>.

## 2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

### A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
5. Glass thicknesses listed are minimum.

### B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.

1. In conjunction with vapor retarder and joint sealer materials described in other sections.
  - a. Refer to Section 07 2500.

### C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

## 2.3 GLASS MATERIALS

### A. Float Glass: Provide float glass based glazing unless noted otherwise.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.

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4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

### 2.4 INSULATING GLASS UNITS

#### A. Manufacturers:

1. Any of the manufacturers specified for float glass.
2. Guardian Glass, LLC; [www.guardianglass.com](http://www.guardianglass.com).
3. PPG Industries, Inc: [www.ppgideascales.com](http://www.ppgideascales.com).
4. Viracon, Apogee Enterprises, Inc: [www.viracon.com](http://www.viracon.com).

#### B. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Black.
5. Edge Seal:
  - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
  - b. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.
8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
  - a. Breather Tubes: Seal or crimp breather tubes upon installation in accordance with insulating glass fabricator's requirements.
  - b. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
  - c. Inert gas may be installed in the field into air space in accordance with insulating glass fabricator's and installer's requirements.

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### 2.5 GLAZING UNITS

- A. Type G1 - Insulating Glass Units: Vision glass, double glazed.
  - 1. Applications: Exterior glazing unless otherwise indicated.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Tint: Gray.
    - b. Coating: Self-cleaning type, on #1 surface.
    - c. Coating: Low-E (passive type), on #2 surface.
  - 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Tint: Clear.
  - 5. Total Thickness: 1 inch.
  - 6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.30, nominal.
  - 7. Visible Light Transmittance (VLT): 30 percent, nominal.
  - 8. Shading Coefficient: 0.28 percent, nominal.
  - 9. Solar Heat Gain Coefficient (SHGC): 0.25 percent, nominal.
- B. Type G1A - Insulating Translucent Glass Units: Basis of Design: Solera L.
  - 1. Applications: For Four-Fold Door System.
  - 2. Space between lites filled with air.
  - 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Surface 2: Light diffusing veil.
    - b. Surface 3: Light diffusing veil.
  - 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Tint: Clear.
  - 5. Total Thickness: 1 inch.
  - 6. Thermal Transmittance (U-Value): 0.47, nominal.
  - 7. Shading Coefficient: 0.28 percent, nominal.
  - 8. Solar Heat Gain Coefficient (SHGC): 0.25 percent, nominal.



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- C. Type G2 - Monolithic Interior Vision Glazing:
  - 1. Applications: Interior glazing unless otherwise indicated.
  - 2. Glass Type: Fully tempered float glass.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.
  - 5. Glazing Method: Dry glazing method, gasket glazing.
- D. Type G3: Exterior insulating 1" Translucent Unit by Okalux of Solera –
  - 1. 1/4" clear glass with Low E on #2 surface.
  - 2. Space: 1/2" air space w OKAPANE T - PMMA acrylic, UV stable, capillary slab encased in SAB fiber tissue. Capillaries are not to exceed 3mm diameter to assure proper diffusion
    - a. Dual sealed units: Primary sealant: Polyisobutylene Secondary sealant: Silicone
  - 3. 1/4" clear glass, IS 20 Coating on #4 Surface.
- E. Type G3.1: Exterior Overhead door 1/2" Low-E Insulated Tempered Glazing
- F. Type G3.2: Exterior Overhead door 1/2" Low-E Obscure Insulated Tempered Glazing

### 2.6 BACKPAINTED GLASS:

- A. Type G4: Back Painted Glass: Mirror-quality glass with heat-cured paint coating applied to second surface.
  - 1. Basis of Design Product: Gardner Glass Products, Inc., Dreamwalls® Backpainted Glass.
  - 2. Color: As indicated on Drawings.
  - 3. Size: As indicated on Drawings.
  - 4. Glass Finish: Classic Glossy.
  - 5. Attachment Methods: Channels and adhesive.
  - 6. Cutout and Penetrations: As indicated on Drawings. Field verify prior to fabrication.
  - 7. Glass Edge Treatment: Flat polished.
- B. Provide back painted glass meeting or exceeding the following physical characteristics:
  - 1. Coating Adhesion: ASTM D3359: 5 of 5.
  - 2. Water Immersion, 65 deg. C, 40 days: ASTM D870: Pass.
  - 3. Hardness: ASTM D3363: Pass 1H pencil after 24-hour aging.

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4. Scratch Test: ASTM D2197: Pass 1.9 kg weight.
  5. UV Resistance: ASTM D4587 313 Method, second surface: Pass 1000 hours.
  6. Chemical Resistance: ASTM C650: Pass vinegar alkali test.
- C. Glass for White and Color Coatings: ASTM C1036, Mirror Select Quality; ultra-clear (low iron) float glass with a minimum 91 percent visible light transmission.
1. Basis of Design Product: PPG Industries, Inc., Starphire® Ultra-Clear Mirror.
  2. Nominal Thickness: 6 mm (1/4 inch).
- D. Coating: Heat-cured acrylic epoxy and protective paint layers applied to second surface.
- E. Adhesive: Adhesive setting compound, asbestos-free, certified by both back painted glass manufacturer and adhesive manufacturer as compatible with glass coating and substrates. Use adhesive with VOC content of 70 g/L or less per 40 CFR 59, Subpart D (EPA Method 24).
- F. Channels: Manufacturer's standard stainless steel , matched set of bottom and top channels, size to match glass thickness.
- G. Z-Clips: Manufacturer's standard.

### 2.7 FIRE RATED GLAZING

- A. Type G5 - Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period of 60 minutes or less.
1. Applications:
    - a. Glazing in fire-resistance-rated door and window assemblies.
  2. Glass Type: Safety ceramic glass.
  3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
  4. Safety Glazing Certification: 16 CFR 1201 Category II.
  5. Glazing Method: As required for fire rating.
  6. Fire-Rating Period: As indicated on drawings.
  7. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on
    - a. fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
    - b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
    - c. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.

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- d. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
  - e. "XXX" - placeholder that represents fire-rating period, in minutes.
8. Products:
- a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-XL: [www.safti.com/#sle](http://www.safti.com/#sle).
  - b. Basis of Design: Technical Glass Products; Firelite NT: [www.fireglass.com/#sle](http://www.fireglass.com/#sle).
  - c. Vetrotech North America; Keralite/Select: [www.vetrotechusa.com/#sle](http://www.vetrotechusa.com/#sle).
  - d. Substitutions: See 01 25 00 - Substitution Procedures.

### 2.8 GLAZING COMPOUNDS

- A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.
- B. Type GC-2 - Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- C. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

### 2.9 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
  - 1. Width: As required for application.
  - 2. Thickness: As required for application.
  - 3. Spacer Rod Diameter: As required for application.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

**3.2 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
  - 1. Install glass in accordance with instructions contained in the Flat Glass Jobber's Glazing Manual and GANA Guidelines. Use workmen specialized in the application of glass and sealants. Apply glazing compound or gaskets in accordance with manufacturer's recommendations.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.
- G. Set all glass in a true plane, tight and straight, with proper and adequate clearance, firmly anchored to prevent rattling and looseness, with all edges cleanly cut.
- H. Install setting blocks at 1/4 points or at location as recommended by GANA, the glass manufacturer, or as required by structural calculations. In no case shall edge of block be closer than 6" to the vertical edge of the glass unless specifically approved otherwise in writing by the glass manufacturer. Setting blocks shall be restricted from lateral movement. Setting blocks at insulated glass units and laminated glass shall support both lites of glass.
- I. Apply glazing sealants under pressure with hand or power actuated gun or other appropriate means. Use gun having nozzle of proper size and provide sufficient pressure to completely fill joint. Neatly point or tool all joint surfaces to provide the proper contour.
- J. Cut glass at factory to exact size with proper edge clearance so that glass will not contact frame at any point. Do not nip or seam the edges except where required for a heat treating process.
- K. Do not mark installed glass with an "X", or other symbol, or with any material whatsoever. Tapes or banners may be fastened to the frame head and suspended over the glass. Any stickers, separators or

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glass identification markings applied to the glass must be on the inboard surface. No stickers or separators shall be on the exterior (number one surface) when glass is installed.

- L. Apply masking tape, where required by glazing operation, in continuous strips in alignment with joint edge. Remove tape immediately after joints have been sealed and tooled. Dry tool joints. Do not use water-wet tool or tooling solution.
- M. Follow sealant manufacturer's instructions regarding mixing, surface preparation, priming, application procedure.
- N. Fabricate and install all glass so roller marks from heat strengthening process are in the horizontal position. Mixing the direction will not be acceptable.
- O. Use of temporary wedge gaskets or dutchmans shall be in accordance with GANA and glass manufacturer's recommendation.
- P. Factory molded corners on gaskets must be set in a wet compatible no-curing sealant or compatible wet silicone.
- Q. Install fire knock-out decals, as required, if marking is an applied decal. Otherwise, if permanent etching or marking is required, install glass so factory applied marking is in correct location.
- R. When using interior set (dry) gasket glazing, cut glazing tape to length and set against permanent stops, projecting 1/16" above sight line. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit. Place glazing tape on free perimeter of glazing in same manner described above. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

### 3.3 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### 3.4 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

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- F. Carefully trim protruding tape with knife.

### 3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

### 3.6 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.
- E. Glass scratched or otherwise damaged during cleaning shall be removed and replaced at no additional cost to the Owner. Dispose of excess materials, containers and debris from site.

### 3.7 PROTECTION

- A. The Contractor shall exercise extreme caution and care to protect exposed non-coated surfaces from scratching or abrading until the Owner occupies the building.
- B. Remove scratched, abraded or otherwise damaged glass and replace with new damage-free glass by the Contractor, at no expense or cost to the Owner.
- C. Protect all glass from weld splatter. Remove glass with weld splatter or burns and replaced at no expense or cost to the Owner.
- D. Completely cover glass during spray painting, texturing or other construction operations that might cause damage to glass.
- E. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION 08 8000**

**SECTION 09 0561  
COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient tile and sheet.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

**1.2 RELATED REQUIREMENTS**

- A. Section 014500 - Quality Control: Additional requirements relating to testing agencies and testing.
- B. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- C. Section 03 3000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

**1.3 REFERENCE STANDARDS**

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2023.
- B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

**1.5 SUBMITTALS**

- A. See Section 013300 - Submittal Requirements, for submittal procedures.

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- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Submit report to Architect.
  - 7. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.

### 1.6 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  - 1. Provide access for and cooperate with testing agency.
  - 2. Confirm date of start of testing at least 10 days prior to actual start.
  - 3. Allow at least 4 business days on site for testing agency activities.
  - 4. Achieve and maintain specified ambient conditions.
  - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

### 1.7 DELIVERY, STORAGE, AND HANDLING

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- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

### 1.8 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

## PART 2 PRODUCTS

### PART 3 EXECUTION

#### 3.1 CONCRETE SLAB PREPARATION

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
  - 1. Preliminary cleaning.
  - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
  - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 5. Specified remediation, if required.
  - 6. Patching, smoothing, and leveling, as required.
  - 7. Other preparation specified.
  - 8. Adhesive bond and compatibility test.
  - 9. Protection.

#### 3.2 MOISTURE VAPOR EMISSION TESTING

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- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

### 3.3 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### 3.4 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### 3.5 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.

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- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

### 3.6 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

### 3.7 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

### 3.8 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION 09 0561**

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**SECTION 09 2116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Gypsum sheathing.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.
- E. Textured finish system.
- F. Water-resistive barrier over exterior wall sheathing.
- G. Acoustic (sound-dampening) wall and ceiling board.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 07 2100 - Building Insulation: Acoustic insulation.

**1.3 REFERENCE STANDARDS**

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2023.
- D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2022.
- E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- H. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.

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- I. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018 (Reapproved 2023).
- J. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- K. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2023.
- L. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- O. ASTM E413 - Classification for Rating Sound Insulation 2022.
- P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- Q. GA-216 - Application and Finishing of Gypsum Panel Products 2021.
- R. GA-600 - Fire Resistance and Sound Control Design Manual 2021.
- S. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

## PART 2 PRODUCTS

### 2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.

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- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
  - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
  - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

### 2.2 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  - 1. Basis of Design: Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 2. Acceptable Manufacturers:
    - a. PABCO Gypsum: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).
    - b. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
    - c. Or Approved Equal.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
  - 4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 5. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
  - 6. Mold Resistant Paper Faced Products:
    - a. Georgia-Pacific Gypsum; ToughRock Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).

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- b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- 7. Glass Mat Faced Products:
  - a. Georgia-Pacific Gypsum; DensArmor Plus: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - b. Georgia-Pacific Gypsum; DensArmor Plus Fireguard C: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- C. Abuse Resistant Wallboard:
  - 1. Application: All Corridors and as indicated on Drawings.
  - 2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. Glass Mat-Faced Type: Gypsum wallboard, as defined in ASTM C1658/C1658M.
  - 5. Type: Fire-resistance-rated Type X, UL or WH listed.
  - 6. Thickness: 5/8 inch.
  - 7. Edges: Tapered.
  - 8. Paper-Faced Products:
    - a. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 9. Glass Mat Faced Products:
    - a. Georgia-Pacific Gypsum; DensArmor Plus Abuse-Resistant: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- D. Backing Board For Wet Areas: One of the following products:
  - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
    - a. Regular Type: Thickness 1/2 inch.
    - b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
    - c. Products:
      - 1) Georgia-Pacific Gypsum; DensShield Tile Backer: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

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1. Application: Vertical surfaces behind FRP/FRL except in wet areas.
  2. Edges: Tapered.
  3. Products:
    - a. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - b. Georgia-Pacific Gypsum; DensArmor Plus: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
  2. Thickness: 1/2 inch.
  3. Edges: Tapered.
  4. Products:
    - a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
  4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  5. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  6. Core Type: Regular and Type X, as indicated.
  7. Type X Thickness: 5/8 inch.
  8. Regular Board Thickness: 5/8 inch.
  9. Edges: Square.
  10. Glass Mat Faced Products:
    - a. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - b. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).



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- H. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
  2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
  3. Types: Regular and Type X, in locations indicated.
  4. Type X Thickness: 5/8 inch.
  5. Regular Type Thickness: 1/2 inch.
  6. Edges: Tapered.
  7. Products:
    - a. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).

### 2.3 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: See Section 07 2100.
- B. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
  2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- C. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch length, applied to bottom edge of gypsum board.
1. Height: 1/2 inch.
  2. Depth: 1/2 inch.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
  2. Joint Compound: Setting type, field-mixed.
- E. Finishing Compound: Surface coat and primer, takes the place of skim coating.
- F. High Build Drywall Surfacers: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Textured Finish Materials: Latex-based compound; plain.

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- H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

#### **3.2 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

#### **3.3 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- F. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
  - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- G. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- H. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

#### **3.4 INSTALLATION OF TRIM AND ACCESSORIES**

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- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
  - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

### 3.5 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Walls to receive textured wall finish.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 6. Level 0: Temporary partitions.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

### 3.6 TEXTURE FINISH

- A. Texture Required: Light Knockdown.

### 3.7 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION 09 2116**

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**SECTION 09 2216  
NON-STRUCTURAL METAL FRAMING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal partition, ceiling, and soffit framing.
- B. Drywall Suspension Systems
- C. Framing accessories.
- D. Sheet Metal Backing

**1.2 RELATED REQUIREMENTS**

- A. Section 05 2100 - Steel Joists: Execution requirements for anchors for attaching work of this section.
- B. Section 05 4000 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.
- C. Section 05 4000 - Cold-Formed Metal Framing, for exterior nonloading bearing structural metal stud framing, interior wall openings greater than 8 feet wide, and headers, interior soffits and ceilings where;
  - 1. Load is greater than 20 psf transverse
  - 2. Load is greater than 200 lbs axial.
- D. Section 05 4000 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.
- E. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.
- F. Section 05 5000 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
- G. Section 072100 - Thermal Insulation: Acoustic insulation.
- H. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings
- I. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- J. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- K. Section 09 2116 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

**1.3 REFERENCE STANDARDS**

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- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- K. ASTM E413 - Classification for Rating Sound Insulation 2022.
- L. ASTM F1267 - Standard Specification for Metal, Expanded, Steel 2018 (Reapproved 2023).
- M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- N. Steel Stud Manufacturers Association (SSMA).
- O. Steel Framing Industry Association (SFIA).

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
  - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

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3. Provide shop drawings and calculations prepared by an engineer registered in the State of Nevada as required in this Section including:
  - a. Suspension systems.
  - b. Ceiling framing and soffits.
  - c. Engineering analysis depicting stress and deflection requirements for each framing application.
  - d. Selection of framing components, accessories, fasteners, and welded connection requirements.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
  1. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.
- B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-structural steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by, and displaying a classification label from, an independent testing agency acceptable to authority having jurisdiction.
  1. Construct fire-resistance-rated partitions in compliance with tested assembly requirements indicated on the Drawings.
  2. Rated assemblies to be substantiated from applicable testing using the proposed products, by Contractor.
  3. Both metal framing and wallboard manufacturers must submit written confirmation that they accept the other manufacturer's product as a suitable component in the assembly. Acceptance is as follows:
    - a. If installation of both products is proper, no adverse effect will result in the performance of one manufacturer's product by the other's products.
    - b. Combining products can be substantiated by required assembly tests.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- D. Sound test reports must be from an independent laboratory accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program

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(NVLAP).

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

A. Furnish products as Manufactured by a Manufacturing member of the Steel Stud Manufacturers Association (SSMA) [www.ssma.com](http://www.ssma.com), or Steel Framing Industry Association (SFIA) and subject to compliance with Specification requirements.

1. Metal Framing, Connectors, and Accessories:

- a. CEMCO: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
- b. ClarkDietrich Building Systems: [www.clarkdietrich.com](http://www.clarkdietrich.com).
- c. SCAFCO Corporation: [www.scafco.com/#sle](http://www.scafco.com/#sle).
- d. Approved Equal.

B. Substitutions: 012500 - Product Substitutions.

#### 2.2 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as follows:

B. Loadbearing Studs: As specified in Section 05 4000.

C. Non-Loadbearing (Interior) Framing System Components: ASTM C645; (min. G40), galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Interior Studs @ Wet Walls: C shaped with flat or formed webs, punched, and size as indicated on the drawings with knurled faces, hotdipped galvanized steel with a protective coating equal to G60 min.
2. Curved Stud and Track Components: 2 1/2 inch, 3 5/8 inch and 6 inch hand shapeable, pivotal track components manufactured of structural Grade 22, hotdipped galvanized steel with a protective coating equal to G60, as manufactured by:
  - a. Basis of Design: FlexC Trac by FlexAbility Concepts, Edmond, OK (405) 3020611
  - b. Custom curved stud and track components as manufactured by RadiusTrack Corporation, 6612 Lyndale Avenue South, Suite 2, Richfield, MN 55423 (888) 8723487.
3. Runners: U-shaped, sized to match studs.
4. Ceiling Channels: C shaped, cold-rolled.
5. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

D. Sound isolation clips

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1. Manufacturer: Kinetics Noise Control, Dublin, Ohio; Product: Model Iso-Max Sound Isolation Clips. <http://www.kineticsnoise.com/arch/isomax.html>
  2. Vertical Load capacity. Clips shall have sufficient capacity to support wall or ceiling weights as constructed. In a vertical load test comparable to a ceiling installation, the clip shall have a minimum design load capacity of 36 lbs. using 25 gauge furring channel. The minimum design load capacity when using 22 gauge furring channel shall be 48 lbs. Design Load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum Design Load. Anchors for attachment of the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.
  3. The isolation clips shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8 in. x minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
- E. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
1. Coordinate materials found in this section with applications and materials found in Section 092116. Non-Load bearing gypsum wall assemblies for use in the following areas:
    - a. Shaft Wall Application: Mechanical Shafts.
    - b. Shaft Wall Width; CH-Stud & E-Stud with J-Runner: As indicated on Drawings.
      - 1) Providing continuous edge support for Liner Panel edges.
      - 2) Hot-dipped galvanized, lengths as required.
    - c. Shaft Wall Material Thickness: As indicated on Drawings.
    - d. Shaft Wall Deflection: L/240.
  2. Manufacturers - Shaft Wall Studs and Accessories:
    - a. Same manufacturer as other framing materials.
  3. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Drywall Suspension System:
1. Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635, with exposed surfaces finished in manufacturer's standard enamel paint finish.
  2. Fire rating: 1, 1-1/2, 2, 3, or \_\_\_ hour rating in accordance with UL assembly indicated.
  3. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
  4. Accessories:
    - a. U-shaped channel molding.



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- b. Galvanized carbon steel (12 ga.) hanger wire.
- 5. Acceptable product: Equivalent to Drywall Suspension System by USG.
- G. Ceiling Isolation Hangers: Provide hangers and accessories as manufactured by Kinetics Noise Control, Inc., Dublin, Ohio.
- H. Compression Struts: C- shape steel studs. in minimum thickness as required to adequately resist the vertical component induced by the bracing wires in suspended ceiling applications.
- I. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  - 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- J. Non-Loadbearing Framing Accessories:
  - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
  - 3. Blocking: Install mechanically fastened steel channel blocking for support of:
    - a. Framed openings.
    - b. Wall-mounted cabinets.
    - c. Plumbing fixtures.
    - d. Toilet partitions.
    - e. Toilet accessories.
    - f. Wall-mounted door hardware.
    - g. Other wall mounted items
  - 4. Sheet Metal Backing: 1/16 inch thick, galvanized.

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- a. 16 gauge minimum galvanized steel sheet.
  - b. 16 gauge minimum cshaped steel stud.
  - c. "NotchTite" and "Flush Mount" as manufactured by Metal Lite, Inc., 3070 E. Miraloma Avenue, Anaheim, CA 92806 (800) 8866824.
5. Fasteners: ASTM C1002 self-piercing tapping screws.
- a. GA 203, selfdrilling, selftapping screws.
6. Anchorage Devices: Powder actuated.
7. Acoustic Insulation: See Section 07 2100.
- K. Clips, Brackets: ASTM A653 Galvanized wire or sheet metal designed for attachment of framing, furring and bridging members.
1. Deflection Clips: If acceptable to Building Official, VertiClip™ as manufactured by Signature Industries, LLC, P.O. Box 68005, Raleigh, NC 27613 (919) 8440789 may be provided for attachment of framing to roof and floor construction at head and slip conditions. Provide sizes as required for stud depth(s). Clips shall be manufactured of steel conforming to ASTM A 653 Prime Certified G60 galvanized material or better, 50 ksi yield strength and 65 ksi ultimate strength. Deflection clips to have positive attachment to structure and stud material while allowing for frictionless movement.
  2. Bridging Clips: If acceptable to Building Official, BridgeClip™ as manufactured by Signature Industries, LLC, P. O. Box 68005, Raleigh, NC 27613 (919) 8440789 may be provided for attachment of bridging to studs.

### 2.3 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

### 3.2 INSTALLATION OF STUD FRAMING

- A. Comply with requirements of ASTM C754.
- B. Extend partition framing to structure where indicated and to ceiling in other locations as indicated on the drawings.

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- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Align and secure top and bottom runners at 24 inches on center and within 6 inches from the end.
- F. At partitions indicated with an acoustic rating:
  - 1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
  - 2. Place two beads of acoustic sealant between runners and substrate , studs and adjacent construction.
  - 3. Place two beads of acoustic sealant between studs and adjacent vertical surfaces. At exterior wall conditions, install felt strips between the stud and wall.
- G. At partitions indicated with a fire rating: Install framing and furring indicated for the required rating.
- H. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- I. Install studs vertically at spacing indicated on drawings.
- J. Align stud web openings horizontally.
- K. Secure studs to bottom track using fastener method. Do not weld.
- L. Stud splicing is permissible; splice studs with 8 inch nested lap, secure each stud flange with flush head screw.
- M. Fabricate corners using a minimum of three studs.
- N. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- O. Brace stud framing system rigid.
- P. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.
- Q. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- R. Blocking: Use steel channels secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.

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- S. Sound Isolation Clips: Mechanically attach to framing or structure with fasteners recommended by clip manufacturer. Install at spacing indicated on drawings.
- T. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.
- U. Use sheet metal backing, 16 gauge minimum for reinforcement of all wall mounted items and items requiring backing per manufacturer's instructions..

### 3.3 CEILING AND SOFFIT FRAMING

- A. Comply with requirements of ASTM C754.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- I. Laterally brace suspension system.
- J. Provide separate support members on each side of control or expansion joints. Do not bridge.

### 3.4 SOUND ISOLATION CLIP INSTALLATION

- A. General – Install work in accordance with the manufacturer's approved product installation procedures.
- B. Spacing and location of sound isolation clips shall be determined by the manufacturer based on wall or ceiling type. Installation drawing details shall be provided by the manufacturer to assure optimum sound control and structural integrity of the system.

### 3.5 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

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**END OF SECTION 09 2216**

**Non-Structural Metal Framing - 09 2216**

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**SECTION 09 3000  
TILING**

**PART 2 PRODUCTS**

**1.1 SETTING MATERIALS**

**1.2 GROUTS**

**END OF SECTION 09 3000**

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**SECTION 09 5100  
ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.2 RELATED REQUIREMENTS**

- A. Section 09 2116 - Gypsum Board Assemblies: Suspension system as a substrate for this section.

**1.3 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2023.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2023.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- J. ASTM E1477 - Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers 1998a (Reapproved 2022).
- K. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- L. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2021a.
- M. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2023.

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- N. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2021a.
- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- P. CHPS (HPPD) - High Performance Products Database Current Edition.
- Q. ICC (IBC) - 2018 - International Building Code 2018.
  - 1. with Southern Nevada Amendments.
- R. International Code Council-Evaluation Services - Evaluation Report, ESR-1308, Fire and Nonfire-Resistance-Rated Suspended Ceiling Framing Systems.
- S. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2024.
- T. UL (FRD) - Fire Resistance Directory Current Edition.
- U. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

### 1.5 SYSTEM DESCRIPTION

- A. Seismic Loads: Design and size components to withstand seismic loads in accordance with the International Building Code, Section 1613 for Category C.

### 1.6 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit 4 samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Certifications: Manufacturer's certifications that system complies with specified requirements:
  - 1. For seismic performance: International Code Council Evaluation Report, ESR-1308



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2. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Acoustical Units: Quantity equal to 10 percent of total installed.
- I. Warranty: Manufacturer's standard warranty for extent of conditions allowable and duration of warranty

### 1.7 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
  1. Surface Burning Characteristics: As follows, tested per ASTM E84 and complying with ASTM E1264 for Class A products.
    - a. Flame Spread: 25 or less
    - b. Smoke Developed: 50 or less
- B. Single Source Responsibility: To obtain Lifetime ceiling system warranty, 30-year ceiling system warranty, color match or ceiling panel and suspension system compatibility, all acoustical panel and suspension system components shall be produced and supplied by one manufacturer. Materials supplied by more than one manufacturer are not acceptable
- C. Source quality control:
  1. Test reports: Manufacturer will provide test certification for minimum requirements as tested in accordance with applicable industry standards and/or to meet performance standards specified by various agencies.
  2. Changes from system: System performance following any substitution of materials or change in assembly design must be certified by the manufacturer.
  3. All ceiling panel cartons must contain UL label for acoustical compliance.
  4. All suspension system cartons must contain UL label for load compliance per ASTM C635.
- D. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.
- E. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- F. Seismic Performance:

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1. Provide acoustical ceiling system that has been evaluated by an independent party and found to be compliant with the IBC 2018 International Building Code, Seismic Category C.
  - a. Tested per International Code Council - Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components as evidenced by International Code Council Evaluation Report, ESR-1308
- G. Requirements of regulatory agencies: Codes and regulations of authorities having jurisdiction.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

### 1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
  1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
  2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

### 1.10 WARRANTY

- A. See Section 01 78 36 - Warranties and Bonds, for additional warranty requirements.
- B. Provide manufacturer's standard warranties agreeing to repair or replace acoustical panels and suspension systems that fail within the warranty period. Failures include manufacturing defect, sagging and warping of acoustical panels, and rusting of grid system.
  1. Warranty Period:
    - a. Acoustical Panels: Manufacturer's standard maximum warranty for each type of panel used.
    - b. Grid and Suspension System: Manufacturer's standard maximum warranty, but not less than 10 years.

### 1.11 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

1. Acoustic Tiles/Panels:

a. USG: [www.usg.com](http://www.usg.com).

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).

2. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).

C. Suspension Systems:

1. Same as for acoustical units.

**2.2 PERFORMANCE REQUIREMENTS**

A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119 and complying with the following:

B. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:

1. Local authorities having jurisdiction.

**2.3 ACOUSTICAL UNITS - GENERAL: ASTM E1264, CLASS A.**

A. VOC Content: Certified as Low Emission by one of the following:

1. Product listing in UL (GGG).

2. Product listing in CHPS (HPPD).

B. Provide panel products matching Manufacturer's designations indicated on Drawings and complying with the following:

1. Light reflectance of LR-1 (over 75 percent), per Fed. Spec. SS-S-118B and ASTM E1264 for factory finished panels. Field painted panels are not required to comply.

**2.4 ACOUSTICAL PANELS, TYPE C-1A: PAINTED MINERAL FIBER, WITH THE FOLLOWING CHARACTERISTICS:**

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- A. Item #: 4913 - Application(s): As indicated on Drawings.
- B. Classification: ASTM E1264 Type III.
  - 1. Form: 2, water felted.
  - 2. Pattern: CE.
- C. Size: 24 by 48 inches.
- D. Thickness: 5/8 inch.
- E. Light Reflectance: 0.86 percent, determined in accordance with ASTM E1264.
- F. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
- G. Panel Edge: Square.
- H. Tile Edge: Square.
  - 1. Joint: Kerfed and rabbeted.
- I. Color: White.
- J. Suspension System Type G1: Exposed grid.
- K. Products:
  - 1. USG Corporation; Olympia Micro Acoustical Panels: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).

**2.5 ACOUSTICAL PANELS, , TYPE C1-B: PAINTED MINERAL FIBER, WITH THE FOLLOWING CHARACTERISTICS:**

- A. Item #: 4210 - Application(s): As indicated on Drawings.
- B. Classification: ASTM E1264 Type III.
  - 1. Form: 2, water felted.
  - 2. Pattern: CE.
- C. Size: 24 by 24 inches.
- D. Thickness: 5/8 inch.
- E. Light Reflectance: 0.86 percent, determined in accordance with ASTM E1264.
- F. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
- G. Panel Edge: Square.
- H. Tile Edge: Square.

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- I. Color: White.
- J. Suspension System Type G2: Exposed grid.
- K. Products:
  - 1. USG Corporation; Olympia Micro Acoustical Panels: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).

### 2.6 SUSPENSION SYSTEM(S)

- A. Manufacturers:
  - 1. Same as for acoustical units.
  - 2. Grid System: Refer to Drawings and Material Schedule.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- C. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
  - 1. Materials:
  - 2. Suspension system shall support the ceiling system specified with a maximum deflection of 1/360 of the span.
- D. Exposed Suspension System, Type G1: Hot-dipped galvanized steel grid with steel cap.
  - 1. Application(s): Seismic.
  - 2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  - 3. Profile: Tee; 15/16 inch face width.
  - 4. Finish: Baked enamel.
  - 5. Color: White.
  - 6. Products:
    - a. USG Corporation; DX 15/16 Inch Suspension System: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
- E. Exposed Suspension System, Type G2: Hot-dip galvanized steel grid and cap.
  - 1. Application(s): Seismic.
  - 2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  - 3. Profile: Tee; 9/16 inch face width.

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4. Finish: Baked enamel.
5. Color: White.
6. Products:
  - a. USG Corporation; Donn Brand Centricitee DXT/DXLT 9/16 inch Acoustical Suspension System: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
- F. Components: Main beams and cross tees In accordance with the International Building Code,
  1. Structural Classification: ASTM C635, Intermediate Duty.
  2. Exposed Tee System - 9/16" or 15/16". Refer to Drawings and Material Schedule.
  3. Main-Runners: Minimum of 1.64 inch in height with an exposed capped face of width of 15/16 inch, unless otherwise indicated on Drawings.
  4. Cross-Tees: Minimum of 1-1/2 inch or 1-1/4 inch in height with an exposed capped face in a width to match main runners.
  5. Finish: Exposed faces of main and cross runners shall be a baked enamel paint finish, Colors as follows:
    - a. White and match the actual color of the selected ceiling tile, unless noted otherwise.
- G. Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, Direct Hung unless otherwise indicated.
  1. In accordance with the International Building Code, Section 1613 for Category C.
- H. Wire for Hangers and Ties:
  1. ASTM A641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.
- I. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.
  1. In accordance with the International Building Code, Section 1613 for Category C or method as described in ESR-1308.
    - a. Nominal 7/8 inch x 7/8 inch hemmed, pre-finished angle molding.
    - b. Nominal 15/16 inch x 15/16 inch hemmed, pre-finished angle molding.
- J. Compression Struts: C-shaped steel stud in compliance with Section 09 21 16. Provide in minimum thickness as required to adequately resist the vertical component induced by the bracing wire

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- K. Hold-Down Clips: Provide access type hold-down clips where required by Acoustical Ceiling Manufacturer for type and condition and where panels weigh less than one pound per square foot.
- L. Enclosure for Recessed Ceiling Fixtures: Mineral fiber insulation box enclosure with foil facing on exterior side for placement over recessed ceiling light fixture; flame spread index of 25 and smoke development index of 0 (zero) when tested in accordance with ASTM E84.
  - 1. Light Fixture Size: As indicated on drawings.
  - 2. Insulation Thickness: 1-1/4 inch, nominal.
  - 3. Thermal Resistance: R-value of 4.2 (degrees F hour square foot) per Btu per inch at 75 degrees F, minimum, when tested according to ASTM C518.
  - 4. Provide enclosure with documented noise reduction coefficient (NRC) in accordance with ASTM C423 of at least 1.00 at 2 inches thick.
  - 5. Provide enclosure with documented ceiling attenuation class (CAC) in accordance with ASTM E1414/E1414M.

### 2.7 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- E. Perimeter Moldings: Same metal and finish as grid.
  - 1. Size: As required for installation conditions and specified Seismic Design Category.
  - 2. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### 3.2 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

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### 3.3 INSTALLATION - (CATEGORY C)

- A. Install suspension system and panels in accordance with the International Building Code, Section 1613, except as noted in Section 4.4.3.2 of ESR-1308, and with the authorities having jurisdiction.
- B. ESR-1308, Section 4.4.3.2, Seismic Design Category C Installation:
  - 1. Terminal ends of the runners are secured by attaching the BERC-2 clip to the wall molding and attaching the runners to the BERC-2 clip. The runners have zero clearance at the perimeter on two adjacent walls and with 3/8-inch (9.5 mm) clearance on the opposite walls. The clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading, in lieu of spacer bars required in CISCA 0-2, which is referenced in ASCE 7, Section 9.6.2.6.2.1, which is referenced in IBC Section 1621. Except for the use of the BERC-2 clip as noted above, installation of the ceiling system must be as prescribed by the applicable code. Maximum ceiling weight permitted is 1.20 pounds per square foot (5.86 kg/m<sup>2</sup>). This construction is equivalent to that required by CISCA 0-2, which is referenced in ASCE-7, Section 9.2.6.2.1, and which is referenced in IBC Section 1621.
- C. The presence of a hanger wire within 3 inches of an expansion relief joint as called for in ASTM C 636 shall be required in addition to the requirements of the International Building Code, Section 1621.2.5 and with the authorities having jurisdiction.

### 3.4 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Install in bed of acoustical sealant.
  - 2. Use longest practical lengths.
  - 3. Overlap and rivet corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.



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- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

### 3.5 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
  - 1. Cut to fit irregular grid and perimeter edge trim.
  - 2. Make field cut edges of same profile as factory edges.
  - 3. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.
- I. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
- J. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- K. Install hold-down clips on panels within 20 ft of an exterior door.

### 3.6 LIGHTING FIXTURES:

- A. All light fixtures shall be mechanically attached to the suspension system per NEC 410-16 (two per fixture unless the fixture is independently supported).
- B. Support of rigid lay-in (Type \_\_) or can light fixtures:

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1. Each fixture less than 10 lbs. shall have a single wire (wire may be slack) attached from the fixture to structure.
2. Each fixture that weighs between 10 and 56 lbs. shall have two wires (wires may be slack) attached at diagonal corners of the fixture to structure.
3. Each fixture greater than 56 lbs. shall be directly supported to structure by approved hangers.
4. Pendant light fixtures shall be directly supported from structure with 9-gauge wire (or approved alternative).

### 3.7 AIR TERMINALS:

- A. Air terminals less than 20 lbs. shall be positively attached to the suspension system.
- B. Air terminals that weigh between 20 and 56 lbs. shall be mechanically attached to the suspension system. Two slack wires shall be attached from the housing to structure.
- C. Air terminals in excess of 56 lbs. shall be directly supported to structure by approved hangers.

### 3.8 SPRINKLER HEADS AND OTHER PENETRATIONS

- A. Shall have 3/8" clearance on all sides.

### 3.9 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### 3.10 CLEANING

- A. See Section 01 7300 - Execution Requirements for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

### 3.11 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- C. Removal of debris: Remove all debris resulting from work of this section.

## END OF SECTION 09 5100

### Acoustical Ceilings - 09 5100

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**SECTION 09 6500  
RESILIENT FLOORING, WALL BASE AND ACCESSORIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Resilient base.
- B. Installation accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

**1.3 REFERENCE STANDARDS**

- A. ANSI/ESD STM7.1 - The Protection of Electrostatic Discharge Susceptible Items Flooring Systems Resistive Characterization 2021.
- B. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine 2017.
- C. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers 1998 (Reapproved 2023).
- D. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials 2021a, with Editorial Revision.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- F. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring 2006 (Reapproved 2018).
- G. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading 2022.
- H. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

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- J. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers Current Edition, Including All Revisions.

### 1.4 SUBMITTALS

- A. See Section 01 3300 - Submittal Requirements for submittal procedures.
- B. Product Data: Provide data for each specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
  - 1. Include information stating Static Coefficient of Friction.
  - 2. MSDS
    - a. Submit Material Safety Data Sheets (MSDS) available for flooring products, adhesives, patching/leveling compounds, floor finishes (polishes) and cleaning agents.
  - 3. For resilient products. Use same designations indicated on Drawings.
- C. Shop Drawings: Indicate seaming plan, coving details.
- D. Samples
  - 1. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
  - 2. Verification Samples: Submit 4 samples, 4 1/2 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
  - 1. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- F. Closeout Submittals: Submit the following:
  - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Section 01 7800 - Closeout Procedures and Submittals.
    - a. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing and precautions against cleaning materials and methods detrimental to finishes and performance.
  - 2. Warranty: Provide warranty documents specified herein from all manufacturers.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 40 square feet of each type and color.

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3. Extra Wall Base: 25 linear feet of each type and color.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum five years documented experience.

### 1.6 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- B. Select an installer who is competent in the installation of resilient resilient tile flooring.
- C. Provide static dissipative resilient tile, static dissipative adhesive, copper grounding strips, and static dissipative floor finish supplied by the manufacturer.
- D. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
  1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
  2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.
- E. Provide flooring material to meet the following electrical properties when installed according to manufacturer's instructions with the required adhesive:
  1. ANSI/ESD S7.1 :Floor Materials-Resistive Characterization of Materials results between 106 and 109 ohms
  2. ASTM F 150 (Electrical Resistance of Flooring) between 106 and 109 ohms.
  3. ANSI/ESD STM 97.1: Floor Materials and Footwear-Resistance in Combination with a Person results between 106 and 109 ohms
  4. ANSI/ESD STM 97.2: Floor Materials and Footwear Voltage Measurement in Combination with a Person) - less than 10 volts with dissipative footwear at 20% relative humidity.
  5. Static Dissipation @ 12% RH: Flooring in combination with a person wearing dissipative footwear - 1000 to 100 volts:0.2 seconds average
- F. Slip resistance of floor surfaces and changes in level shall be in accordance with applicable law.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

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- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 65 degrees F and 85 degrees F.in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- D. Maintain the ambient relative humidity between 40% and 60% during installation.
- E. Protect roll materials from damage by storing on end.
- F. Do not double stack pallets.
- G. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- H. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

### 1.8 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 85 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.
- B. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

### 1.9 WARRANTY

- A. See Section 0 17836 - Warranties and Bonds, for additional warranty requirements.
- B. Resilient
  - 1. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- C. Warranty Period
  - 1. Warranty Period: 5 years
- D. Rights

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1. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

### E. Validation

1. For the Warranty to be valid, this product is required to be installed using the appropriate Armstrong Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS:

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.

1. Approved Manufacturer(s): Refer to Drawings and Material Schedules.
  - a. As specified in this section for other products.

- B. Substitutions: Refer to Section 012500 - Substitution Procedures.

### 2.2 TILE FLOORING

- A. Static Dissipative Tile, Type F-5 :: Tile Flooring composed of polyvinyl chloride resin binder, fillers, pigments, and antistatic additive with colors and texture dispersed uniformly throughout its thickness.

#### 1. Manufacturers:

- a. Basis of Design: Tarkett Inc; Product Primo SD: [www.tarkett.com](http://www.tarkett.com).
- b. Acceptable Manufacturers:
  - 1) Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2) Mannington Mills, Inc: [www.mannington.com](http://www.mannington.com).
- c. Substitutions: See Section 01 60 00 - Product Requirements.

2. Minimum Requirements: Vinyl composition tile shall meet size, thickness, indentation, impact, dimensional stability, resistance to chemicals, and squareness requirements of ASTM F1066, Class 2 – through pattern.

3. Size: 24" x 24" x 1/8"

#### 4. Design and Color:

- a. Type F-5: Refer to Drawings and Material Schedule.

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### 2.3 RESILIENT BASE

- A. Resilient Base - Type: B1 & B3: Conforming to ASTM F1861, Type TP -- Thermoplastic rubber; top set Style B, Coved, Group 1, and as follows:
  - 1. Manufacturers:
    - a. Acceptable Manufacturers:
      - 1) Basis of Design: Johnsonite, a Tarkett Company: [www.johnsonite.com](http://www.johnsonite.com).
      - 2) Mannington Commercial: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
      - 3) Roppe Corporation: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - b. Or Approved Equal.
    - c. Substitutions: Refer to Section 012500 - Substitution Procedures.
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
  - 3. Height: 4.5 inch., Coved as indicated on Drawings and Material Schedule.
  - 4. Thickness: 1/8 inch thick.
  - 5. Finish: Matte.
  - 6. Length: Roll.
  - 7. Color: As indicated on drawings.
  - 8. Accessories: Premolded external corners and internal corners.

### 2.4 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Grounding Strips for Static Dissipative Tile: Manufacturer's standard copper grounding strips.
- D. Moldings, Transition and Edge Strips: Same material as flooring. Provide transition/reducing strips tapered to meet abutting materials.
- E. Filler for Coved Base: Plastic.
- F. Sealer and Wax: Types recommended by flooring manufacturer.
- G. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

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**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- E. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.
- F. Verify that required floor-mounted utilities are in correct location.

**3.2 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.
- B. Prepare substrates according to Johnsonite written instructions to ensure adhesion of Conductive Resilient Flooring.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Mechanically remove contamination on the substrate that may cause damage to the Conductive Resilient Flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
  - 4. Prepare Substrates according to ASTM F 710 including the following:
    - a. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

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- 1) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.
- C. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- D. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- E. Floor covering shall not be installed over expansion joints.
- F. Do not install resilient products until they are same temperature as the space where they are to be installed.
  1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 INSTALLATION - GENERAL

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Dissipative Resilient Flooring :
  1. Install with adhesive as recommended in Manufacturer's Electrostatic Installation Instructions and specified for the site conditions and follow adhesive label for proper use.
  2. Install with Mfr. approved copper grounding strips per Mfr's installation instructions.
  3. Static Dissipative Resilient Flooring Tile does not require welded seams.
- C. Starting installation constitutes acceptance of subfloor conditions.
- D. Install in accordance with manufacturer's written instructions.
- E. Adhesive-Applied Installation:
  1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 0526 for grounding and bonding to building grounding system.
  2. Fit joints and butt seams tightly.
  3. Set flooring in place, press with heavy roller to attain full adhesion.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

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1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
  2. Resilient Strips: Attach to substrate using adhesive.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. At movable partitions, install flooring under partitions without interrupting floor pattern.
- I. Install copper grounding strips into adhesive in strict accordance with manufacturer's written instructions.
- J. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- K. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

### 3.4 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

### 3.5 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### 3.6 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

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- D. Apply overlap metal edge strips where shown on the drawings, after flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

### 3.7 CLEANING

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage.
- C. Wait 72 hours after installation before performing initial cleaning.
- D. Sweep and vacuum surfaces thoroughly.
- E. Clean, seal, and wax in accordance with manufacturer's written instructions.
- F. A regular maintenance program must be started after the initial cleaning.

### 3.8 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

**END OF SECTION 09 6500**

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**SECTION 09 6566  
RESILIENT ATHLETIC FLOORING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Interlocking, loose-laid installation rubber tile.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 09 6500 - Resilient Flooring, Wall Base and Accessories.

**1.3 REFERENCE STANDARDS**

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).
- B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- C. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.
- E. Verification Samples: Actual flooring material specified, not less than 12 inch square, mounted on solid backing.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.6 DELIVERY, STORAGE, AND HANDLING**

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- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

### 1.7 FIELD CONDITIONS

- A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

### 1.8 WARRANTIES

- A. See Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Manufacturer shall provide a five (5) year warranty against manufacturing defects.

## PART 2 PRODUCTS

### 2.1 PREFORMED ATHLETIC FLOORING

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Approved Manufacturer(s):
    - a. American Floor Mats 152 Rollins Ave #102 Rockville, MD 20852: [www.americanfloormats.com](http://www.americanfloormats.com)
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. No Fault Sport Group: [www.nofault.com](http://www.nofault.com).
  - 2. Ultimate RB: [www.ultimaterb.com](http://www.ultimaterb.com).
  - 3. U.S. Rubber Recycling, Inc: [www.usrubber.com/#sle](http://www.usrubber.com/#sle).
- C. Substitutions: 012500 - Substitution Procedures.
- D. Rubber Tile Flooring: High-quality rubber gym tiles formed into interlocking tiles, and free-laid without adhesive.
  - 1. Base of Design Product: Extreme Rubber Gym Tiles.
  - 2. VOC Content: Certified as Low Emission by one of the following:

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- a. Product listing in UL (GGG).
3. Thickness: Minimum 1 inch.
4. Size: Nominal 24 inch square.
5. Tensile Strength: Minimum 150 psi, per ASTM D412.
6. Durometer Hardness, Type A: Minimum of 55, when tested in accordance with ASTM D2240.
7. Tile Edge/Installation: Interlocking shape, loose-laid installation.
8. Surface Texture: Smooth.
9. Color: As indicated on Drawings.

### 2.2 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 09 0561.
  2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

### 3.2 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### 3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Rubber Tile Flooring:

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1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Install loose-laid tile in a staggered pattern; fit interlocking edges tightly.

### 3.4 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

### 3.5 PROTECTION

- A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

**END OF SECTION 09 6566**



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**SECTION 09 6723  
RESINOUS FLOORING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Resinous flooring system and base as shown on the Drawings and in Schedules.
- B. Coved seamless wall base.
- C. Edge-protection and transition profiles for floors.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-In-Place Concrete.
- B. Section 07 92 00 - Joint Sealants.
- C. Section 09 0561 - Common Work Results for Flooring Preparation.

**1.3 REFERENCE STANDARDS**

- A. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes 2023.
- B. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser 2019.
- C. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers 2022.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

**1.4 SYSTEM DESCRIPTION**

- A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy primer, and a decorative epoxy based broadcast seamless flooring system.
- B. The system shall have the color and texture as specified by the Owner with a thickness of 20 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- C. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

**1.5 SUBMITTALS**

- A. See Sections 01 3300 - Submittal Requirements , for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:

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1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.
  4. Manufacturer's Safety Data Sheet (SDS) for each product being used.
- C. Test Reports: Certified test and evaluation reports from a qualified independent third party agency demonstrating compliance with specified performance characteristics and physical properties.
- D. Product Schedule: For each type of resinous flooring, designate using finish codes from the Drawings.
- E. Verification Samples: Minimum size 12 inches by 12 inches (305 by 305 mm) by full thickness of each resinous flooring system specified to show color and texture with specified coats cascaded to show each layer.
- F. Closeout Submittals:
1. Repair and touch up kits.
  2. Cleaning and maintenance instructions.
  3. Warranty.

### 1.6 MOCK-UPS

- A. Prior to commencing work, at Architect's discretion, applicator shall install a 100 square foot sample on the job of desired color and texture and when approved, this will serve as the standard for the entire project.
- B. Finish areas designated by Architect.
- C. Do not proceed with remaining work until workmanship is approved by Architect.
- D. Refinish mock-up area as required to produce acceptable work.
- E. Approved mock-up may remain as part of finished work and shall set the standard of acceptance for remaining work.

### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years experience in the production, sales, and technical support of similar systems with sufficient capacity to produce and deliver required materials without causing delay in work, and capable of providing field quality control during construction.
- B. Installer Qualifications: Minimum 7 years experience installing similar products and certified by the manufacturer.
- C. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section.

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Contractor shall have completed at least five projects of similar size and complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

- D. Surfacing shall be applied by a surfacing applicator approved by the Architect, with a minimum of seven (7) years experience installing the brand of surfacing in similar size and function projects. A list of ten (10) completed projects using the specified materials must be submitted proving seven (7) years experience by the lead mechanic.
- E. Surfacing applicator shall provide to the architect a completed list of jobs including the names of the Architect, General Contractor, and Owner, telephone numbers of all concerned, materials used, quantity installed and date completed on similar projects.
- F. Surfacing applicator must provide a written joint guarantee for materials and workmanship between applicator and surfacing manufacturer for one (1) year.
- G. Surfacing applicator or manufacturer seeking approval of products other than what is specified must supply samples, full product information, technical data with specifications, certification from an independent testing laboratory that the product being submitted for approval meets all requirements of the performance properties specified within this specification, installation instructions and comply with the above quality assurances in writing fourteen (14) days before bid letting.
  - 1. Omission of any item will result in an automatic rejection.
  - 2. Bidders will be notified by addendum of substitute surfacing materials, if approved.

### 1.8 OPERATION AND MAINTENANCE

- A. Data: Submit maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- B. Manufacturer's representative to provide a physical maintenance training demonstration to Owner's maintenance staff.

### 1.9 PROJECT CONDITIONS

- A. Before commencing work, ensure environmental and site conditions are suitable for application and curing.
- B. Surfaces shall be acceptable in accordance with flooring manufacturer's recommendations.
  - 1. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.
- C. Conditions of new concrete to be coated with decorative epoxy material.
  - 1. Concrete shall be cured for a minimum of 28 days prior to the application of the coating system pending moisture tests.
  - 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).

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3. Sealers, release agents and curing membranes should not to be used.
  4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.
- D. Notify Architect and Contractor in writing of unsuitable surfaces and conditions. Commencement of work shall imply acceptance of surfaces and working conditions.
1. Recommended Moisture Vapor Transmission Considerations:
    - a. Placement of on-grade slabs over a Class A vapor retarder as defined by ASTM E1745.
    - b. A water cement ratio of 0.45 and 0.5.
    - c. Curing by ASTM C171 sheet materials for curing concrete.
    - d. A slump in the range of 3 to 4 inches which can be increased by the use of super plasticizers.
- E. Maintain minimum temperature in storage area of 75 degrees F.
- F. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and after installation of materials.

### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

### 1.11 PROTECTION

- A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means.

### 1.12 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds, for additional warranty requirements.
- B. Provide manufacturer's standard 1 year limited warranty defects in materials.
- C. Applicator shall notify manufacturer of project requirements before bidding. Manufacturer shall provide single source warranty for entire installation including labor for two years. Warranty shall include removal and replacement if proven defective. Defective items are but not limited to debonding, discoloration, excessive wear and staining by bodily fluids.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract documents is not

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changed, as determined by the Architect.

1. Approved Manufacturer: FlowResin (Key Resin), which is located at: 4050 Clough Woods Dr.; Batavia, OH 45103; Toll Free Tel: 888-943-4532; Tel: 513-943-4225; Fax: 513-943-4255; Web:www.keyresin.com/flowcrete.
  2. Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901- 5841. Tel.: (800) 472-4588. Fax: (800) 477-9783. E-mail: specassist@schluter.com. Internet: www.schluter.com.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract.
1. Dur-A-Flex, Inc: Hybri-Flex EC (self-leveling chip broadcast), epoxy/aliphatic urethane topcoat seamless flooring system.
  2. Stonehard:1000 East Park Avenue, Maple Shade, NJ 08052, 800.257.7953.
  3. Or Approved Equal.
- C. Substitutions: 012500 - Product Substitutions.

### 2.2 GENERAL

- A. System Description: Work includes concrete testing, mechanical substrate preparation, primer application, and installation of resin systems, including integral cove base where indicated, at thickness specified below to match accepted samples.

### 2.3 FLOORING

- A. Type F-3: Seamless Flooring: FlowResin(Key Resin), Peran STB Broadcast, hard wearing double broadcast epoxy flooring system comprised of the following components:
1. System Materials:
    - a. Primer: Flowprime EPW Base A and Hardener B.
    - b. Floor Layer: Flowseal EPW Base A and Hardener B.
    - c. Flakes: Colored Flakes.
    - d. Sealer: Flowcrete Peran STC Base A and Hardener B
    - e. Topping: Flowseal PU Gloss.
  2. Thickness: 1/8".
- B. Type B-2: Cove Base: Provide 6" high turned up coved base with 1" radius cove as indicated on drawings, for an integral seal at the joint between the floor and the wall.

### 2.4 ACCESSORIES

- A. Patch Materials:

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1. Shallow Fill and Patching up to 1/4 inch (6 mm): Flowcrete Americas, Flowprime scratchcoat produced by adding clean dry sand to Flowprime.
2. Deep Fill and Sloping Material over 1/4 inch (6 mm): Flowcrete Americas, Flowtex.

### 2.5 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS

- A. Transition Strip Type TR-1: Basis of Design: Schluter®-SCHIENE.
1. Description: L-shaped profile with 1/8" (3.2 mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
  2. Anchoring Leg:
    - a. Provide with straight anchoring leg
    - b. Provide with special radius anchoring leg for radius applications
  3. Material and Finish:
    - a. AE - Satin Anodized Aluminum
  4. Height: 3/32".
- B. Consult Schluter®-Systems' current technical literature for proper design and installation instructions.

### 2.6 FINISHES

- A. Provide the following finishes as selected by the Architect from manufacturers full range of colors and textures. Confirm each product and finish combination through the sample submittal process.
- B. Flake Blends: Refer to drawings - Material Schedule.

## PART 3 EXECUTION

### 3.1 TESTING OF CONCRETE SUBSTRATE:

- A. Refer also to 09 0561 - Common Work Results for Flooring Preparation.
- B. Moisture Testing: Perform moisture vapor emission (calcium chloride) test in accordance with ASTM F1869 including:
1. Perform three tests for the first 1,000 square feet (93 square meters) and then one test per subsequent 1,000 square feet (93 square meters).
  2. Application may only proceed when the vapor/moisture emission rates does not exceed 3 pounds per 1,000 square feet (1.36 kg per 93 square meters) in 24 hours.
  3. If the vapor drive exceeds limit specified above, install manufacturer's recommended vapor mitigation system to lower the value to the acceptable limit.

### 3.2 EXAMINATION

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- A. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
- B. Concrete surfaces shall be free of laitance, oil, grease, curing compounds, loose particles, friable matter, dirt, bituminous products and all other contaminants.
- C. Concrete shall have a steel trowel finish.
- D. Sealers and curing agents should not to be used.
- E. Verify floor surfaces are smooth and flat with maximum variation of 1/8 inch in 10 feet and are ready to receive work.

### 3.3 APPLICATION

#### A. General

- 1. The system shall be applied in three distinct steps as listed below:
  - a. Substrate preparation
  - b. Primer application.
  - c. Topping application
- 2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil- free compressed air.
- 3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
- 4. The system shall follow the contour of the substrate unless pitching or other levelling work has been specified by the Architect.
- 5. A neat finish with well-defined boundaries and straight edges shall be provided by the applicator.

#### B. Primer

- 1. The primer shall be mixed and applied per manufacturer recommended procedure.
- 2. The primer shall be comprised of 2 components, Base A and Hardener B as supplied by the manufacturer.
- 3. The primer will be applied at the rate of 100-175 sq ft per gallon.
- 4. Allow material to cure.

#### C. Receiving coat and Topcoat (Topping)

- 1. The topping shall be applied as a broadcast system, color specified by the Architect. It shall be applied in 2 coats with a nominal thickness (including flake) of 75-100 mils.

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### 3.4 APPLICATION

#### A. General

1. The system shall be applied in three distinct steps as listed below:
  - a. Substrate preparation
  - b. Primer application.
  - c. Topping application
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil- free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the applicator.

#### B. Primer

1. The primer shall be mixed and applied per manufacturer recommended procedure.
2. The primer shall be comprised of 2 components, Base A and Hardener B as supplied by the manufacturer.
3. The primer will be applied at the rate of 100-175 sq ft per gallon.
4. Allow material to cure.

#### C. Topping

1. The topping shall be applied as a broadcast system as specified by the Architect. The topping shall be applied in 2 coats with a nominal thickness of 75-100 mils.
2. The topping shall be comprised of 2 components, Base A and Hardener B as supplied by the Manufacturer.
3. The Hardener shall be added to the Base and be thoroughly mixed by suitably approved mechanical means. The topping shall be applied over horizontal surfaces using a rubber squeegee and back-rolled at 60 sq. ft. per gallon.
4. Broadcast to refusal with decorative flakes. Allow to become tack free and then remove all excess and loose flakes.
5. Apply the final sealer coat using a rubber squeegee and back roll. Coverage rate will determine final texture.



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### 3.5 FIELD QUALITY CONTROL

#### A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:

##### a. Temperature:

1) Air, substrate temperatures and, if applicable, dew point.

##### b. Coverage Rates:

1) Rates for all layers shall be monitored by checking quantity of material used against the area covered.

### 3.6 CLEANING

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

### 3.7 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION 09 6723**

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**SECTION 09 6813  
TILE CARPETING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Carpet tile, fully adhered.
- B. Matching roll carpet for direct glue installation on stairs.

**1.2 RELATED REQUIREMENTS**

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

**1.3 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- D. CRI 104 - Standard for Installation of Commercial Carpet 2015.
- E. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints and pattern orientation.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

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1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum 5 years documented experience and approved by carpet tile manufacturer.

### 1.6 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Approved Manufacturer: Tile Carpeting:
  1. Basis of Design: Shaw Industries Group, Inc., a Berkshire Hathaway Company: [www.shawcontract.com](http://www.shawcontract.com).
- B. Acceptable Manufacturers:
  1. Interface, Inc: [www.interface.com/#sle](http://www.interface.com/#sle).
  2. Milliken & Company: [www.milliken.com/#sle](http://www.milliken.com/#sle).
  3. Mohawk Group: [www.mohawkgroup.com/#sle](http://www.mohawkgroup.com/#sle).
  4. Or Approved Equal.

### 2.2 MATERIALS

- A. Tile Carpeting: Type F-3: Tip-Sheared Patterned Loop, manufactured in one color dye lot.
  1. Collection: Hocus
  2. Location: As indicated on Drawings.
  3. Product Style: Observer (Modular) manufactured by Shaw Contract.
  4. Tile Size: 18 x 36 inch, nominal.
  5. Thickness: 0.092 inch.
  6. Color: As indicated on Drawings.
  7. Pattern: Vertical Ashlar.

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8. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  10. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
  11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
  12. Gauge: 5/64 inch.
  13. Stitches: 10.5 per inch.
  14. Density Factor: 7,434 kilotex.
- B. Tile Carpeting: Type F-4: Textured Patterned Loop , manufactured in one color dye lot.
1. Collection: Frixtion.
  2. Location: Entryway Carpet Tile.
  3. Product Style: Force (Modular) manufactured by Shaw Contract.
  4. Tile Size: 18 x 36 inch, (45.72 x 91.44 cm) nominal.
  5. Thickness: 0.185 inch. (4.70 mm).
  6. Color: As indicated on Drawings.
  7. Pattern: Ashlar.
  8. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
  9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  10. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
  11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
  12. Gauge: 1/12 inch.
  13. Stitches: 10 per inch.
  14. Pile Weight: 36 oz/sq yd.
  15. Density Factor: 7,005 kilotex.
  16. Primary Backing Material: Infinity® 2 Modular.

### 2.3 ACCESSORIES

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- A. Edge Strips: Embossed aluminum, color as selected by Architect.
- B. Adhesives:
  - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
  - 3. Follow moisture and alkalinity remediation procedures in Section 09 0561.
- E. Verify that required floor-mounted utilities are in correct location.

#### **3.2 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

#### **3.3 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.

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- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

**3.4 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION 09 6813**

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**SECTION 09 7213  
DIGITAL PRINTED VINYL WALLCOVERING MURALS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provide digitally printed wallcovering vinyl wallcovering, complete.

**1.2 RELATED SECTIONS**

- A. Section 092116 - Gypsum Board Assemblies: Wall Substrates. Level 5 Finish requirements.
- B. Section 099100 - GLASS RAILING SYSTEMS: Preparation and priming of substrate surfaces.

**1.3 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.
- C. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials 2006.
- E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2024.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
- G. WA-W-101-2017 - Quality Standard for Polymer Coated Fabric Wallcovering.
- H. Federal Specifications (FedSpec):
  - 1. CCC-W- 408A - Wallcovering, Vinyl Coated

**1.4 SUBMITTALS**

- A. See Sections 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data:
  - 1. Product data for vinyl film, overlay film and inks.
  - 2. Installation and maintenance instructions, including removal of graffiti.
  - 3. Submit MSDS sheets for adhesives, sealants, adhesives, primers, paints and cleaning agents used on the application of the films.
- C. Shop Drawings: Submit the following:

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1. Floor plans indicating location of each graphic.
  2. Elevations of each graphic showing mounting heights, graphic dimensions and locating distances. Show all existing and new wall-mounted items such as fire hose and fire hydrant cabinets, plaques and signage, electrical outlets and switches, access panels, etc. Indicate the items that will temporarily be removed and reinstalled after application of graphic. Callout the items that will remain in place and indicate how the graphic will be placed around them.
  3. Provide isometric drawings for graphics designed over two or more adjacent surfaces.
- D. Submit one Color Proof for approval prior to manufacture of a full size miniature mural.
- E. Submit one full size miniature strike-off for approval prior to the manufacture of full size mural.
1. Submit manufacturers' product data and installation instructions for each digitally printed wallcovering mural, adhesive and accessory required.
    - a. Include data on physical properties, fire hazard classification and fire detection characteristics of wallcovering.
    - b. Include manufacturer's recommendations for maximum permissible moisture content of substrates.
  2. Submit full-size samples, 54 inches wide by 36 inches long, cut from current production of each ground wallcovering selected to demonstrate quality, weight, color and embossing.
- F. Submit manufacturer's written product certification that all furnished wallcovering ground meets or exceeds the specification requirements. Include certified copies of tests specified.
- G. Submit wallcovering ground manufacturer's written instructions for recommended maintenance of each type of wallcovering required.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of digitally printed vinyl wallcovering mural required produced by one manufacturer whose published product literature clearly indicates compliance of wallcovering ground with specified requirements.
- B. Applicator: Installation by skilled commercial wallcovering applicators with no less than three years of documented experience installing wallcovering murals of the types and extent specified for the project.
- C. Material Standards: Provide materials that meet or exceed Federal Specification CCC-W-408A and WA- 101 Quality Standard for Polymer Coated Fabric Wallcovering for Type I and Type II wallcovering.
- D. Physical Properties: Provide wallcovering with the following physical properties when tested in accordance with ASTM D751.
1. Total weight: 21 oz./lin. yd
  2. Tensile Strength: 50 X 55 Minimum (W x F)

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3. Tear Strength: 25 X 25 Minimum (W x F)
4. Fire Hazard Classification: Provide materials that comply with Class A fire rating when tested in accordance with ASTM E84.
5. Underwriters Laboratories approval: Provide materials that have been tested and approved by Underwriters Laboratories.
6. Smoke Toxicity: Provide materials that have been tested for smoke toxicity and approved for use by New York City Materials and Equipment Acceptance Division (MEA).
7. Fire Detection Characteristics: Provide materials that have been laboratory tested for the Early Warning Effect® in accordance with ASTM E603. Submit test results certifying that when one square foot section of the material is heated to 300 degrees F, the wallcovering emits an odorless, colorless non-toxic vapor that will activate an ionization smoke detector.

### 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver digitally printed vinyl wallcovering mural to the project site in unbroken and undamaged wrappings and clearly labeled with the manufacturer's identification label, quality or grade, UL label and sidemark.
- B. Store materials in a clean, dry storage area with temperature maintained above 55 degrees with normal humidity.
- C. Store material in a flat position to prevent damage to roll-ends. Do not cross stack material. Support material off the floor in a manner to prevent sagging and warping.

### 1.7 PROJECT CONDITIONS

- A. Do not apply digitally printed wallcovering mural when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.
- B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 60 degrees F unless required otherwise by manufacturer's instructions.
- C. Apply adhesive only when substrate surface temperature or ambient temperature is above 60 degrees F, or relative humidity is below 40 percent.
  1. Maintain constant recommended temperature and humidity for at least 72 hours prior to, throughout the installation period and for 72 hours after wallcovering installation completion.
  2. Provide not less than an 80 foot candles per square foot lighting level minimum measured mid height at substrate surfaces.

### 1.8 WARRANTY

- A. See Section 017836 - Warranty Procedures for additional warranty requirements.
- B. Film manufacturer shall provide a five year warranty against manufacturing defects, premature failure, excessive dimensional change and loss of adhesion for interior applications and a three year warranty for exterior applications.

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- C. Graphic Fabricator and Installer shall provide a five year fabrication and installation warranty against product failure, adhesion and fading for interior applications and a three year warranty for exterior applications.
- D. Submit manufacturer's 5 year written warranty against manufacturing defects.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Digitally Printed Wallcovering Mural: Koroseal Digitally Printed Wallcovering Murals manufactured by Koroseal Interior Products, LLC. Contact sales representative.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. 3M Commercial Graphics.
  - 2. Avery Dennison.
  - 3. MACtac..
  - 4. Or Approved Equal
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

#### 2.2 MATERIALS

- A. Wallcovering: Koroseal Digital Surfaces Wallcovering , Pattern: Type II conforming to Federal Specification CCC-W-408A and WA-101-A using test methods given in Federal Specification CCC-T-191 b excepted as otherwise specified.
  - 1. Total Weight: 21 ounces per linear yard.
  - 2. Backing Weight: 3.1 ounces per linear yard.
  - 3. Vinyl Weight: 17.9 ounces per linear yard
  - 4. Thickness: 0.018 to 0.026 inches
  - 5. Fabric backing and content: Poly-Cotton Woven
    - a. Digital Image: Owner/Architect to provide PDF file of image to be digitally printed with UV inks on Koroseal Digital Surfaces Type II Wallcovering.
  - 6. Tensile (warpxfill): 50x55 lbs. Minimum

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7. Tear (warpxfill): 25x25 Minimum

### 2.3 ACCESSORIES

- A. Adhesives: Koroseal A-848-B Heavy-Duty Premixed vinyl adhesive.
- B. Substrate Primer/Sealer: White pigmented alkyd or acrylic/latex base primer specifically formulated for use with vinyl wallcoverings.
- C. Metal Moldings: Extruded aluminum, alloy 6063-T5, long lengths, with fine satin mechanical finish and class 2 clear architectural anodic coating conforming to AA M21A31 designed for use with vinyl wallcoverings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and installation conditions.
- B. Test substrates with a suitable moisture meter and verify that moisture content does not exceed 4 percent
- C. Verify substrate surfaces are clean, dry, smooth, structurally sound and free from surface defects and imperfections that would show through the finished surface.
- D. Evaluate all painted surfaces for the possibility of pigment bleed-through.
- E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation. Beginning of installation means acceptance of surface conditions.

### 3.2 WALL PREPARATION

- A. Comply with Manufacturer's requirements for surface preparation.
- B. Repair wall damages, such as holes, loose joints, chipped or peeling paint, remove nails and staples, etc. and return wall to acceptable surface condition to receive graphic.
- C. Clean substrate of substances that can impair the product bond, such as oil, grease, dirt, dust, etc., utilizing OEHS approved cleaning products.
- D. Prime and paint wall per Section 099100 - GLASS RAILING SYSTEMS. Paint the wall with a semi gloss top coat. Do not use matte paint or paint with silicone, graffiti resistant or texturizing additives. Allow the final coat of paint to dry for at least five days prior to installing the graphic.
- E. Perform adhesion test at each wall location to which a graphic will be applied.
- F. Temporarily remove wall applied items for the installation of wall graphic. Reinstall removed items after wall graphic has been applied.

### 3.3 INSTALLATION

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- A. Allow digitally printed vinyl wallcovering mural to acclimatize to the area of installation a minimum of 24 hours before installation.
- B. Before cutting, examine image and color and determine that they are the correct image and color as specified for the correct location.
- C. Read and follow the instructions in the manufacturer's installation sheet contained in each roll of the digitally printed vinyl wallcovering mural.
- D. Use adhesive recommended by the wallcovering manufacturer.
- E. Install each panel in sequence as indicated on the drawings.
- F. If there are variations in color or image that are considered to be excessive, notify the manufacturer's representative for an inspection before any further wallcovering is installed.
- G. Smooth wallcovering to the hanging surface using a stiff bristled sweep brush to eliminate air bubbles, wrinkles, gaps and overlaps.
- H. Remove excess adhesive along finished seams immediately after each wallcovering strip applied. Use clean warm water, a natural sponge and clean towels. Change water often to maintain water cleanliness.

### 3.4 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

### 3.5 CLEAN-UP COMPLETION

- A. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the wallcovering installation. Leave areas in neat clean and orderly condition.

**END OF SECTION 09 7213**

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**SECTION 09 9000  
PAINTING AND COATING**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this section.

**1.2 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Exposed surfaces of steel lintels and ledge angles.
  - 3. Prime surfaces to receive wall coverings.
  - 4. Mechanical and Electrical:
    - a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. On the roof and outdoors, paint all equipment that is exposed to weather or to view, including that which is factory-finished.
    - d. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    - e. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

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5. Floors, unless specifically so indicated.
6. Concealed pipes, ducts, and conduits.

### 1.3 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 06 4100 - Architectural Wood Casework: (priming and finishing).
- C. Section 074150 - Expanded Metal Panel Systems:
- D. Section 08 1113 - Hollow Metal Doors and Frames: (pre-finishing).

### 1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.
- B. Touch-Up: Painting of items missed by painter at no additional cost to Owner.
- C. Re-Paint: Repairs to paint work for damages caused by other trades.

### 1.5 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2023.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. GreenSeal GS-11 - Standard for Paints, Coatings, Stains, and Sealers 2021.
- E. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.
- F. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- G. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

### 1.6 SUBMITTALS

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
  1. Provide data on all finishing products and special coatings, including VOC content and;
    - a. Product characteristics.

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- b. Surface preparation instructions and recommendations.
  - c. Primer requirements and finish specification.
  - d. Storage and handling requirements and recommendations.
  - e. Application methods.
  - f. Cleanup Information.
2. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  3. MPI product number (e.g. MPI #47).
  4. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
    - a. Provide product equivalency table.
- C. Samples: Submit 4 paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
  2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
  3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered, until final color approval.
- E. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.
- F. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; certification is not required but if provided shall constitute acceptable certification.
- G. Manufacturer's Instructions: Indicate special surface preparation procedures.
- H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and coated surfaces, and color samples of each color and finish used.

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1. Coating Maintenance Manual: upon conclusion of the project, the Contractor or paint manufacture/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Paint and Coatings: 1 gallon of each color; store where directed.
  3. Label each container with color, type, texture, room locations, and shelf life in addition to the manufacturer's label.

### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.
- C. Standards: Preparation, application and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
  1. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual" and "Standards".
    - a. PDCA P2-13: Third Party Inspections: Qualifications, Responsibilities, and Procedures.
    - b. PDCA P3-13: Designation of Paint Color.
    - c. PDCA P4-13: Responsibility for Inspection and Acceptance of Surfaces Prior to Painting and Decorating.
    - d. PDCA P5-13: Benchmark Sample Procedures for Paint and Other Decorative Coating Systems.
  2. Gypsum Association - GA-232-04: "Painting New Gypsum Board".

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

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### 1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Environmental Requirements: Do not apply exterior paint in damp or rainy weather or until after the surface has dried thoroughly from the effects of such weather.
  - 1. Do not apply varnish or paint when temperature is below 50 degrees F. Avoid painting surfaces exposed to hot sunlight.
  - 2. During interior application, maintain minimum temperature of 65 degrees F. unless otherwise directed by Architect or manufacturer's printed instructions. Hold temperature as constant as possible.
  - 3. Provide adequate ventilation at all times so the humidity cannot rise above the dew point of the coldest surface to be painted.
  - 4. Moisture-containing surfaces, such as concrete, stucco and cement plaster shall have a moisture content of less than 8 percent as measured by moisture meter. Remove surface salt deposits prior to painting. Verify that pH is neutral, or within acceptable limits of Paint Manufacturer. Paint after thoroughly cured.
- D. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- E. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- F. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- G. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Furnish products of one of the following manufacturers, except as otherwise approved by Architect, subject to compliance with specification requirements.
  - 1. Sherwin Williams: [www.sherwin-williams.com](http://www.sherwin-williams.com)
  - 2. Dunn-Edwards Corporation: [www.dunnedwards.com](http://www.dunnedwards.com)
  - 3. Benjamin Moore: [www.benjaminmoore.com](http://www.benjaminmoore.com)

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4. Behr Process Corporation: www.behr.com
  5. Tnemec (High Performance Finish Systems Only) www.tnemec.com
- C. Specialty Paint Products and Finishes: As specified on Drawings and Material Schedule.
- D. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
  3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
  4. Substitutions Requests must include a equivalency table between specified and proposed substitution paint systems.
- E. Substitutions: Refer to Section 012500 - Substitution Procedures.

### 2.2 MATERIALS

- A. Provide materials in accordance with the Schedule of Paint Products at the end of this Section as applicable to project. Contractor shall provide either waterborne or solventborne products at contractor's option and as follows:
1. Waterborne:
    - a. Provide where low odor and fast dry are desired.
    - b. Non-blocking materials shall be used for doors, door jambs, railings and other locations subject to handling, or where surfaces will come into contact with other painted surfaces or belongings.
  2. Solventborne:
    - a. Provide where harder finish is required (such as "wet" areas) and odor will not create problems with occupants.
    - b. These products shall not be used where color retention is a concern. Verify with Architect.
  3. Materials used shall comply with applicable Federal and local air pollution regulations, lead content laws, and current VOC requirements. If products listed in Schedule of Paint Products located at the end of this Section are not in compliance with regulations, laws, or requirements, Contractor shall notify Architect and shall provide information regarding substitute products.
- B. Basic painting materials such as linseed oil, shellac, turpentine, thinners, driers, and other similar products, shall be of highest quality, made by reputable, recognized manufacturers, and have identifying labels on containers. Paint materials shall be factory fresh.

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- C. Alternate materials submitted for prior approval shall have qualities and materials equal to the other listed manufacturer's scheduled, top of the line, first quality products. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.
- D. Standard Gloss Range: Provide paints in accordance with the following MPI standard ranges as measured in accordance with ASTM D523, and as indicated on the drawings:

<b>MPI Gloss and Sheen Standards</b>	<b>Gloss @ 60°</b>	<b>Sheen @ 85°</b>
Gloss Level 1 - traditional matte finish - flat	max 5 units, and	max. 10 units
Gloss Level 2 – high side sheen flat – ‘velvet-like’ finish	max 10 units, and	10-35 units
Gloss Level 3 – traditional ‘eggshell-like’ finish	10-25 units, and	10-35 units
Gloss Level 4 – ‘satin-like’ finish	20-35 units, and	min. 35 units
Gloss Level 5 – traditional semi-gloss	35-70 units	
Gloss Level 6 – traditional gloss	70-85 units	
Gloss Level 7 – a high gloss	More than 85 units	

- E. Paints shall be ready mixed except for field catalyzed coatings.

**2.3 PAINTS AND COATINGS - GENERAL**

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 5. Supply each coating material in quantity required to complete entire project's work from a single production run.
  - 6. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

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- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; [www.otcair.org](http://www.otcair.org); specifically:
      - 1) Opaque, Flat: 50 g/L, maximum.
      - 2) Opaque, Nonflat: 150 g/L, maximum.
      - 3) Opaque, High Gloss: 250 g/L, maximum.
      - 4) Varnishes: 350 g/L, maximum.
    - c. Architectural coatings VOC limits of Nevada.
  2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Chemical Content: The following compounds are prohibited:
1. Intentionally added methylene chloride or perchloroethylene.
  2. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
  3. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.
- E. Flammability: Comply with applicable code for surface burning characteristics.
- F. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- G. Colors: As indicated in Material Schedule.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

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3. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

### 2.4 PAINT - EXTERIOR

- A. All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry, brick, cement board, primed wood, and primed metal.

1. Preparation as specified by manufacturer.
2. Two top coats and one coat primer recommended by manufacturer.
3. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, 214.
4. Primer On Concrete and Concrete Masonry: One heavy coat latex block filler (100 percent acrylic) squeegeed into pores.
5. Primer on Plaster:

#### B. EXTERIOR PAINT SYSTEMS

1. This schedule uses the generic names listed in the Schedule of Paint Products.
2. System 101 (Ferrous Metals): Apply to exposed steel such as metal doors and frames, grilles, light fixture standards in parking areas, sectional and coiling doors, and other exposed miscellaneous ferrous metals that are not pre-finished. Refer to "High Performance Finish Systems" for high performance paint finish applied to exterior steel canopies, ornamentation, handrails and railings which are not pre-finished.
  - a. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
  - b. 2nd Coat: Same material as 3rd coat in accordance with manufacturer's recommendations.
  - c. 3rd Coat:
    - 1) Flat: Paint - Waterborne (100% Acrylic) (if noted on Drawings). Sheen shall be 4 to 6% per a 85 degree gloss meter.
    - 2) Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
3. System 102 (Galvanized Metals): Apply to exposed galvanized metal such as copings, louvers and metal flashings.
  - a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer).
  - b. 1st Coat: Galvanized Metal Primer.

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- c. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
  - d. 3rd Coat:
    - 1) Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise.
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
4. System 103 (Aluminum): Apply to exterior louvers and other miscellaneous exposed exterior unfinished aluminum surfaces.
- a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
  - b. 1st Coat: Aluminum Primer.
  - c. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
  - d. 3rd Coat:
    - 1) Flat: Paint, Flat - Waterborne (100% Acrylic) (if noted on Drawings) Sheen shall be less than 10% per a 85 degree gloss meter.
    - 2) Semi-Gloss unless noted otherwise. Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - non-Blocking).
5. System 104 (Concrete Masonry Units): Apply to exterior concrete masonry unit construction indicated to be painted. Roller apply 2nd or 3rd coat.
- a. 1st Coat: Concrete Masonry Block Filler. Provide Level 2 or 3 Fill as required by gloss.
  - b. 2nd Coat: Same materials as 3rd coat as recommended by manufacturer.
  - c. 3rd Coat:
    - 1) Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss (if noted on Drawings): Enamel, Gloss - Waterborne(100% Acrylic - Non-Blocking).

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6. System 105 (Concrete and Stucco): Apply to exterior cementitious surfaces as indicated or noted, including tilt-up precast concrete. Precast concrete lintels, beams, caps, sills, etc. at exterior of buildings shall not be painted, unless specifically noted. Roller apply 2nd or 3rd coat.
  - a. 1st Coat: Concrete and Masonry Primer.
  - b. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
  - c. 3rd Coat:
    - 1) Flat: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
7. System 106 (Exterior Wood): Apply to wood fascias, soffits, trim, wood posts, columns, beams and exposed trim and framing where indicated to be painted.
  - a. 1st Coat: Exterior Wood Primer - Waterborne (100% Acrylic) unless noted otherwise.
  - b. 2nd and 3rd Coats:
    - 1) Flat - Rough-Sawn Wood: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 60 degree gloss meter.
    - 2) Semi-Gloss - Smooth Surface Wood (if noted on Drawings): Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
    - 3) Gloss - Smooth Surface Wood (if noted on Drawings): Enamel, Gloss - Waterborne (100% Acrylic - Non-Blocking).
8. System 107 (Exterior Gypsum Board): Apply to exterior grade gypsum board soffits.
  - a. 1st Coat: Exterior Gypsum Board Primer/Undercoater - Waterborne unless noted otherwise.
  - b. 2nd and 3rd Coats: Flat Paint - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 85 degree gloss meter. One of the coats shall be roller applied.
9. System 108 (Sealer - Masonry Parapet Top Surfaces): Apply in accordance with manufacturer's printed instructions.
  - a. 1st Coat: Tamms Industries (Euclid Chemical Company) "Tammolastic" elastomeric acrylic resin based coating, or VIP Ter Polymer Sealants 5000 series. (These products are not listed in the Schedule of Paint Products located at the end of this Section.)
  - b. 2nd Coat: Same material as 3rd coat.
  - c. 3rd Coat: VIP Last-O-Coat 8000 series.

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### 2.5 PAINT - INTERIOR

- A. All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
1. Two top coats and one coat primer.
  2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138-141.
  3. Velvet: MPI gloss level 2; use this sheen as indicated on Drawings.
  4. Eggshell: MPI gloss level 3; use this sheen as indicated on Drawings.
  5. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
  6. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  7. Primer(s): As follows unless other primer is required or recommended by manufacturer of top coats:
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  2. Two top coats and one coat primer.
  3. Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, 141.
  4. Eggshell: MPI gloss level 3; use this sheen as indicated on Drawings.
  5. Satin: MPI gloss level 4; use this sheen as indicated on Drawings.
  6. Semi-Gloss: MPI gloss level 5; use this sheen as indicated on Drawings.
  7. Primer(s): As follows unless other primer is required or recommended by manufacturer of top coats:
    - a. Wood: MPI #39, Latex Primer for Interior Wood.
    - b. Steel, Uncoated: MPI #79, Anti-Corrosive Alkyd Primer for Metal.
    - c. Steel, Uncoated: MPI #107, Rust-Inhibitive Water Based Primer.
    - d. Steel -- Shop Primer: MPI #76, Quick Dry Alkyd Primer for Metal.
    - e. Galvanized Steel: MPI #134, Water Based Galvanized Primer.
    - f. Aluminum: MPI #95, Quick Dry Primer for Aluminum.



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- g. Gypsum Board: MPI #50, Interior Latex Primer Sealer.
  - h. Concrete: MPI #3, Alkali Resistant Water Based Primer.
  - i. Concrete Masonry: MPI #4, Latex Block Filler; heavy coat squeegeed into pores.
  - j. Plaster: MPI #50, Interior Latex Primer Sealer.
- C. Medium Duty Vertical/Overhead: Including gypsum board, plaster, concrete, concrete masonry, uncoated steel, shop primed steel, galvanized steel, and aluminum.
- 1. Two top coats and one coat primer.
  - 2. Primer(s): As recommended by manufacturer of top coats.
    - a. Gypsum Board: MPI #50, Interior Latex Primer Sealer.
    - b. Concrete: Same as top coats.
    - c. Concrete: MPI #3, Alkali Resistant Water Based Primer.
    - d. Concrete Masonry: MPI #4, Latex Block Filler; heavy coat squeegeed into pores.
    - e. Plaster: MPI #50, Interior Latex Primer Sealer.

### D. INTERIOR PAINT SYSTEMS

- 1. This schedule uses the generic names listed in the Schedule of Paint Products.
- 2. System 201 (Ferrous Metals): Apply to exposed metals such as steel doors, hollow metal frames, metal beam saddles, columns, grilles and registers, stair and hand railings, ladders, and other exposed miscellaneous metals.
  - a. 1st Coat: Ferrous Metal Primer (Red or White color as applicable to finish coats).
  - b. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
  - c. 3rd Coat:
    - 1) Eggshell: Enamel, Eggshell.
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss.
    - 3) Gloss (if noted on Drawings): Enamel Gloss.
- 3. System 202 (Interior Wood Finishes - Enamel): Spray apply to wood doors and other exposed miscellaneous wood, wood molding, trim, rails, casing, etc. indicated to be painted. Refer to clear finishes article for wood indicated to be stained or clear finished.
  - a. 1st Coat: Enamel Undercoater.
  - b. 2nd and 3rd Coat:

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- 1) Eggshell: Enamel, Eggshell
  - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
  - 3) Gloss (if noted on Drawings): Enamel, Gloss
4. System 202 (Interior Wood Finishes - Enamel): Spray apply to wood doors and other exposed miscellaneous wood, wood molding, trim, rails, casing, etc. indicated to be painted. Refer to clear finishes article for wood indicated to be stained or clear finished.
- a. 1st Coat: Enamel Undercoater.
  - b. 2nd and 3rd Coat:
    - 1) Eggshell: Enamel, Eggshell
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
    - 3) Gloss (if noted on Drawings): Enamel, Gloss
5. System 203 (Interior Wood Finish - Flat): Apply to plywood telephone backing boards and other miscellaneous softwood as noted, specified or scheduled.
- a. 1st Coat: Enamel Undercoater/Primer.
  - b. 2nd and 3rd Coat: Flat Paint, - Waterborne (Vinyl Acrylic)
6. System 204 (Galvanized Metals): Apply to exposed galvanized metal.
- a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer.  
Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer)
  - b. 1st Coat: Galvanized Metal Primer
  - c. 2nd and 3rd Coats:
    - 1) Eggshell: Enamel, Eggshell
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
    - 3) Gloss (if noted on Drawings): Enamel Gloss
7. System 205 (Aluminum): Apply to interior louvers and other miscellaneous exposed unfinished aluminum surfaces.
- a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer.  
Apply Surface Conditioner or Vinyl Wash Pretreatment.
  - b. 1st Coat: Aluminum Primer
  - c. 2nd and 3rd Coats:

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- 1) Eggshell: Enamel, Eggshell
  - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
  - 3) Gloss (if noted on Drawings): Enamel, Gloss
8. System 206 (Gypsum Board, Plaster and Concrete - Wet Areas): Apply to gypsum board, plaster and concrete surfaces in toilet rooms, janitor rooms, kitchens, and other areas as scheduled.
- a. 1st Coat: Enamel Undercoater - Solventborne, unless noted otherwise.
  - b. 2nd and 3rd Coats:
    - 1) Eggshell (if noted on Drawings): Enamel, Eggshell - Solventborne.
    - 2) Semi-Gloss: Enamel, Semi-Gloss -Solventborne or Enamel -Solventborne (Epoxy-Polyester).
9. System 207 (Gypsum Board, Plaster and Concrete - Non-Wet Areas): Apply to gypsum board, plaster and concrete except for wet areas.
- a. 1st Coat: Waterborne Primer/Sealer. (Solventborne Alkyd shall be used at new untextured smooth gypsum board surfaces covered with powdery or unstable soft top joint cement)
  - b. 2nd and 3rd Coat:
    - 1) Eggshell: Enamel, Eggshell
    - 2) Semi-Gloss (if noted on Drawings): Enamel, Semi-Gloss
    - 3) flat (if noted on Drawings): Paint, Flat
10. System 208 (Ferrous Metal - Chemical Resistant Finish): NOT USED
11. System 209 (Interior Concrete Masonry - Wet Areas): Apply to concrete masonry block units in kitchen, toilet rooms, bathrooms, janitor rooms, vestibules and other walls noted for enamel finish.
- a. 1st Coat: Block Filler, w/o Aggregate. Provide Level 3 Full Fill.
  - b. 2nd Coat: Primer/Sealer or same material as 3rd Coat as recommended by manufacturer.
  - c. 3rd and 4th Coats: Enamel, Semi-Gloss -Solventborne or Enamel -Solventborne (Epoxy-Polyester).
12. System 210 (Interior Concrete Masonry or Plaster - Extremely Wet Areas): Apply to surfaces such as showers.
- a. 1st Coat: Block Filler, w/o Aggregate - Solventborne (Polyamide-Epoxy). Provide Level 3 Full Fill.
  - b. 2nd and 3rd Coats: Enamel, Gloss - Solventborne (Polyamide-Epoxy).

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13. System 211 (Interior Concrete Masonry -Non-Wet Areas): Apply to exposed interior concrete masonry block units except areas specified above for enamel finish.
  - a. 1st Coat: Block Filler, w/o Aggregate. Provide Level 1, 2 or 3 Fill as required by gloss.
  - b. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
  - c. 3rd Coat: Enamel, Semi-Gloss - Waterborne.
14. System 212 (Acoustic Ceilings): Apply to existing acoustic panel or tile ceilings.
  - a. 1st and 2nd Coat: Acoustic Paint.

### 2.6 CLEAR WOOD FINISHES

- A. This schedule uses the generic names listed in the Schedule of Paint Products.
- B. System 301 (Stained and Clear Finish): Apply to wood doors, handrails and chair rails. Fill open grain hardwood such as Oak.
  1. Stained and Finished with Clear Satin or Gloss Varnish - Solventborne:
    - a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil).
    - b. 2nd Coat: Varnish, Gloss - Polyurethane (Solventborne).
    - c. 3rd Coat:
      - 1) Satin: Varnish, Satin - Polyurethane (Solventborne).
      - 2) Gloss: Varnish, Gloss - Polyurethane (Solventborne).
  2. Stained and Finished with Clear Satin or Gloss Varnish- Waterborne:
    - a. 1st Coat: Semi-Transparent Stain - Solventborne (Oil).
    - b. 2nd Coat: Varnish, Gloss - Polyurethane (Waterborne).
    - c. 3rd Coat:
      - 1) Satin: Varnish, Satin - Polyurethane (Waterborne) .
      - 2) Gloss: Varnish, Gloss - Polyurethane (Waterborne).

### 2.7 HIGH PERFORMANCE FINISH SYSTEMS

- A. General: Products included in the following high performance systems are not listed in the Schedule of Paint Products located at the end of this Section.
- B. System 404 (Exterior Steel): Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal).
  1. Clean steel to SSPC-SP6 (Commercial Blast Cleaning).

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2. Fluoropolymer Urethane System (Solvent Base):
  - a. Semi-Gloss Finish:
    - 1) 1st Coat: S-W Macropoxy 646 Fast Cure Epoxy, B58-600 Series. (7.0-13.5 mils wet, 5.0-10.0 mils dry).
    - 2) 2nd Coat: S-W Fluorokem HS Fluoropolymer Urethane, B65-570 Series.
    - 3) 3rd Coat: S-W Fluorokem HS Fluoropolymer Urethane, B65-570 Series. (3.5-5.0 mils wet, 2.0-3.0 mils dry per coat).

### 2.8 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  1. Gypsum Wallboard: 8-12 percent.
  2. Plaster and Stucco: 12 percent.
  3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
  4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

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6. Concrete Floors and Traffic Surfaces: 8 percent.

### 3.2 PREPARATION

#### A. General:

1. Surfaces requiring painting or finishing shall be thoroughly dry and cured, free of dirt, dust, rust, stains, scale, mildew, wax, grease, oil, deteriorated substrates, bond-breakers, efflorescence and other foreign matter detrimental to the coating's adhesion and performance. Repair voids, cracks, nicks and other surface defects with appropriate patching material. Finish flush with surrounding surfaces and match adjacent finish texture.
2. Spot prime marred or damaged shop coats on metal surfaces with appropriate metal primer.
3. Determine moisture content of plaster, stucco, cementitious materials, wood, and other moisture-holding materials by use of a reliable electronic moisture meter.
4. Determine alkalinity of plaster, stucco and other cementitious materials by performing appropriate tests.
5. Do not paint surfaces where moisture content or alkalinity exceeds that which is allowed by paint manufacturer.

#### B. Wood:

1. Sandpaper to smooth and even surface and then dust off. After primer or stain coat has been applied, thoroughly fill nail holes and other surface imperfections with putty tinted with primer or stain to match wood color. Sand woodwork between coats to a smooth surface. Cover knots and sap streaks with a thin coat of shellac, or seal with a suitable stain blocking sealer.
2. Finish door and window edges after final fitting. Finish interior of cabinets in the same manner as the exterior unless otherwise specified. Seal interior of drawers unless otherwise specified.
3. Backpriming:
  - a. Backprime exterior woodwork, which is to receive paint finish, with exterior primer paint.
  - b. Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoater paint.
  - c. Backprime interior and exterior woodwork, which is to receive stain and/or varnish finish with VOC compliant varnish acceptable to the Architect.
  - d. Back-prime wood trim before installation.
4. Where existing stained surfaces are indicated to be coated with a transparent stain, test apply stain to small area where directed by Architect and obtain Architects approval of color.

#### C. Steel and Iron:

1. Remove grease, oil, mill scale, rust and rust scale and touch-up chipped or abraded places on items that have been shop coated. Remove and reprime incompatible or damaged shop applied primers.

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Comply with the Steel Structures Painting Council's (SSPC) recommendations for cleaning of uncoated steel and iron surfaces.

2. When area will be exposed to view, sandpaper the entire primed area smooth, feather the edge of surrounding undamaged prime coat and spot prime in a manner to eliminate evidence of repair.
3. Where steel or iron at existing Work have a heavy coating of scale, remove by sand blasting, sanding, descaling, grinding or wire brushing, as necessary, to produce a satisfactory surface for painting.

### D. Galvanized Metal and Aluminum:

1. Thoroughly clean by wiping surfaces with a non-hydrocarbon solvent that will not leave an oily residue. Apply surface conditioner or vinyl-wash pretreatment as required for proper adhesion if required by paint manufacturer. Prime galvanized metal with galvanized iron primer as recommended by paint manufacturer. A test sample of the complete painting system should be applied and checked for adhesion before final painting begins.
2. Clean visible portions of throats of galvanized steel ductwork with solvent; wipe dry with clean rags and paint flat black.

### E. Concrete:

1. The method of surface preparation shall be at Contractor's discretion, provided the results are satisfactory to the Architect, and the method is in compliance with applicable codes and requirements.
2. Clean and prepare surfaces of tilt-up precast concrete wall panels to be painted by power washing surface to remove all efflorescence, chalk, dust, dirt, grease, oils and release agents.
3. Repair surfaces to be painted prior to application of prime and finish coat(s). Apply a tinted primer to the substrate to help identify surface imperfections. After the primer has thoroughly dried, patch, fill and repair surface imperfections to match and flush-out with adjacent finish texture and profile.
4. Before first paint coat is applied, spot prime nails and other exposed metal occurring in the surfaces with a rust inhibitive primer as recommended by paint manufacturer.

### F. Plaster and Gypsum Board Surfaces:

1. Fill cracks, holes or imperfections with compatible patching material and smooth off to match adjoining surfaces. Before painting, surfaces shall be first tested for dryness with a moisture testing device.
2. Apply no paint or sealer on gypsum board or plaster when the moisture content exceeds 8 percent. Test sufficient areas in each space and as often as necessary to determine if the surface has the proper moisture content for painting. If the moisture content is between 8 percent and 12 percent, prime with alkali resistant primer.
3. If 8 percent or less, prime with specified primer. Remove the dry salt deposits from plaster surfaces by brushing with a stiff brush before painting.

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- G. Acoustical Surfaces (Lay-in acoustical ceiling panels, acoustical wall panels, etc.):
  - 1. Thoroughly vacuum clean surfaces to remove dust and debris from acoustical surface pores. Use a soft brush attachment that will not damage or loosen acoustical surface.
  - 2. Seal surface stains with a suitable stain blocking sealer that will not fill pores of acoustical surface.
  - 3. Apply no paint or sealer on gypsum board or plaster when the moisture content exceeds 8 percent. Test sufficient areas in each space and as often as necessary to determine if the surface has the proper moisture content for painting. If the moisture content is between 8 percent and 12 percent, prime with alkali resistant primer.
- H. Clean surfaces thoroughly and correct defects prior to coating application.
- I. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- J. Remove or repair existing coatings that exhibit surface defects.
- K. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- L. Seal surfaces that might cause bleed through or staining of topcoat.
- M. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- N. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- O. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- P. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- Q. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.
- R. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.
- S. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- T. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- U. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.



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- V. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- W. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- X. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- Y. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- Z. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- AA. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- BB. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.
- CC. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- DD. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### 3.3 WORKMANSHIP

- A. Apply products to achieve paint manufacturer's printed specifications for dry mil thickness
- B. Apply each coat of paint evenly and comply with manufacturer's drying time before applying subsequent coats.
- C. Finished work shall be uniform, match approved color, texture and coverage, and free from runs, sags, clogging or excessive flooding. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping. Where varnishes or enamel is used, lightly sand, dust and clean undercoats to obtain a smooth finish coat. Sand carefully between each coat of finish on smooth surfaces for good adhesion of subsequent coats.
- D. Where clear finishes are required, ensure tinted fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.
- E. Where specific mil thicknesses are required, check thickness by the following methods: Over ferrous metal - Elecometer Film Gauge Other surfaces - Tooke Dry Mil Inspection Gauge.

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### 3.4 APPLICATION

- A. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color and to produce satisfactory finish results.
- B. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
- C. Priming will not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required to ensure an even primed surface before applying finish coat.
- D. Block Fillers: Provide level of block fill as scheduled to conform with the following:
  - 1. Level 1 - Regular Fill: Minimum block fill, reduces irregularity in masonry profile. One coat, spray applied.
  - 2. Level 2 - Medium Full Fill: Masonry profile slightly reduced. One coat, spray applied and back-rolled.
  - 3. Level 3 - Full Fill: Minimum block fill required for semi-gloss and gloss finishes. Use where conformance with health regulations is required. Number of coats as required to conceal most of masonry texture, spray applied and back-rolled.
  - 4. Level 4 - High Density Fill: Minimum of three coats. 1st coat massaged and forced into masonry texture to assure uniform high density. 2nd coat, with build sufficient to fully conceal masonry texture and joints. Additional coats as required to level. Spray apply coats, back-roll and squeegee final coat. Add sand to final coat to achieve light sand texture where indicated.
- E. Plumbing, Mechanical and Electrical:
  - 1. Exterior and interior exposed water, gas, waste piping, sprinkler piping, conduit, lighting and electrical panels, telephone terminal boxes, galvanized ducts and insulated ducts, shall be painted in areas other than mechanical rooms, unless otherwise scheduled.
  - 2. Paint exposed unfinished fixtures, metal ducts, switch boxes, control panels, devices, starters, junction boxes, vents, drains, and other similar items, as directed by Architect.
- F. Spray paint prime coated (not pre-finished) grilles and registers with enamel or lacquer to match walls and ceilings. Paint materials shall not sag, run or bind movable parts of grilles, registers, louvers, baffles and other similar items.
  - 1. Throats of ducts shall be given one coat of flat black paint, wherever visibility of the interior of the duct is allowed through registers or other similar items. At fiber lined duct, use black latex paint.
  - 2. Examine the Mechanical and Electrical Drawings and Specifications to determine the amount of exposed work to be painted.
- G. Paint exposed surfaces of every member; paint items inaccessible after installation before installation, if required to be painted. Edges, tops and bottoms of wood doors shall be sealed and finished with the

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same finish as the door faces, to meet door manufacturer's warranty requirements. Verify edge color with Architect as different colors may be selected for each face.

- H. Paint items fitted with finish hardware after hardware has been temporarily removed.
- I. Heating and other equipment on or adjacent to walls or surfaces scheduled for painting, shall be disconnected, using workmen skilled in appropriate trades and moved temporarily to permit painting of surface. Following completion of painting, replace and reconnect items.
- J. Each succeeding pigmented coat shall be distinguishably lighter than the previous coat. Tint prime and undercoats to a color similar to finish coat. Each coat of material applied must be inspected and approved by the Architect before the application of the succeeding specified coat; otherwise no credit for the concealed coat will be given, and the Contractor shall assume the responsibility to recoat work in question. Contractor shall notify the Architect when each coat is completed.
- K. Brush, wipe or roll stain in 2 coat application. Avoid lap marks by maintaining "wet-edge" continually being merged with existing liquid coverage and stop only at natural edges, turns and breaking places.
- L. Do not paint over Underwriters' Laboratory labels, fusible links, exposed sprinkler heads and other similar items.
- M. Paint piping, electrical or other equipment, conduit, vents and other similar items, on roof or other exterior locations as directed by Architect.
- N. Finish closets with same color as adjoining rooms, unless otherwise specified. Finish other surfaces same as nearest or adjoining surfaces, unless otherwise shown or scheduled.
- O. Paint surface of walls which will be concealed by cabinets and other wall mounted items.
- P. Faux Finish Painting: Provide faux finish of total number coats as required for general painting scheduled for room or area. Use artistic technique(s) as required to achieve desired affect using special tools such as rags, leather, newspaper, feathers, natural sponges, fine-line brushes, etc. as required to provide finished faux painting to match descriptions indicated on Drawings and ID Specifications.
- Q. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- R. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- S. Apply products in accordance with manufacturer's instructions.
- T. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- U. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- V. Apply each coat to uniform appearance.
- W. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

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- X. Sand wood and metal surfaces lightly between coats to achieve required finish.
- Y. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- Z. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- AA. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.5 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
- B. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Architect or Interior Designer:
  - 1. Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  - 2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
  - 4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  - 5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
  - 1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39”).
  - 2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39”).
  - 3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
  - 4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Painted surfaces rejected by the Architect shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.
- E. Paint System Manufacturer’s Technical Representative

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1. The paint system manufacturer's technical representative shall be present at the jobsite for the pre-painting conference and for the first day of paint application, and shall be available for consultation for the full project duration.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Remove oily rags and waste daily, taking precaution to prevent fire.

### 3.7 PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. Touch-up damaged coatings after Substantial Completion.

### 3.8 SCHEDULES

- A. Schedule of Finishes: Refer to Drawings.

**END OF SECTION 09 9000**

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**SECTION 09 9600  
ANTI-GRAFFITI COATINGS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Anti-graffiti coating to exterior exposed masonry surfaces not scheduled to receive other surface coatings or treatments.

**1.2 RELATED SECTIONS**

- A. Section 04 20 00 - Unit Masonry.

**1.3 SUBMITTALS**

- A. See Section 013300 - Execution Requirements and  $\{\text{ch}\#3\}$ , for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on all products. Include:
  - 1. Product description,
  - 2. Tests performed,
  - 3. Limitations to coating,
  - 4. Cautionary procedures required during application
  - 5. Chemical properties.
- C. Manufacturer's Instructions: Include manufacturer's storage, handling, and application instruction for the type of system and applicable details as well as all special precautions required.
- D. Mock-Up: Apply graffiti resistant coating to field mock-up sample representing exterior wall surface to be coated. Apply coating system over a minimum 3 ft x 3 ft test area of each material to receive coating and test removal of applied spray paint in presence of Owner for approval using removal methods recommended by the manufacturer. Coordinate mock-up with 01 45 00 Quality Control

**1.4 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of five (5) years experience.
- B. Installer Qualifications:
  - 1. Successful experience in application of similar finish systems.
  - 2. Employ persons trained for application of finish systems.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

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1. Area shall be the Unit Masonry mock-up panel specified in Section 04 20 00 - Unit Masonry unless another location is designated by Architect.
  2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  3. Refinish mock-up area as required to produce acceptable work.
- D. Single Source Responsibility: Materials shall be products of a single manufacturer.
- E. Pre-installation Meeting:
1. Convene a meeting before the start of the application of. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and applicator.
  2. Review surface preparation, application, protection, and coordination with other work.

### 1.5 MOCK-UPS:

- A. Area shall be the Unit Masonry mock-up panel specified in Section 04 20 00 - Unit Masonry unless another location is designated by Architect.
- B. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
- C. Verify with stone panel/terra cotta panel manufacturer to verify that the applied product doesn't void any warranty.
- D. Refinish mock-up area as required to produce acceptable work.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to job site in manufacturers container, with seals unbroken. Containers shall be properly labeled including product name and ID number.
- B. Keep material protected from the elements and in original unopened containers to prevent contamination by foreign materials.
- C. Protection: Install temporary coverings and protection, and do not allow any coating to contact plastic, planting soil, plants, asphaltic paving, roofing membranes, or other materials that are likely to be damaged by coating.
- D. Weather Conditions: Do not install coating during windy, wet, or excessively hot or dry weather conditions.
- E. Store products in manufacturer's unopened packaging until ready for installation.
- F. Handling: Protect materials during handling and application to prevent damage or contamination.

### 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

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- B. Do not install products under environmental conditions outside manufacturer's recommended limits.
- C. Sealer Coordination:
  - 1. Verify compatibility with curing compounds, patching materials, repair mortar, paints, sealants, to be used on masonry surfaces to ensure compatibility with the anti-graffiti coating.
- D. Exterior Surfaces: Do not apply materials in wet weather.

### 1.8 EXTRA MATERIALS

- A. Furnish extra graffiti removal materials in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.
  - 1. Quantity: (1) 5 gallon pail.

### 1.9 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds, for additional warranty requirements.
- B. Manufacturer shall provide a 10 year material warranty as long as the substrate, application, and removal methods meet their guidelines. For the duration of the warranty, no additional graffiti coatings will need to be applied, and after each graffiti removal the warranty protects against yellowing, shadowing, ghosting, or chemical staining.

## PART 2 PRODUCTS

### 2.1 ANTI-GRAFFITI COATING

- A. Anti-Graffiti coating shall be a clear, non-sacrificial graffiti resistant coating which provides protection for exterior vertical surfaces from permanent graffiti staining and damage caused by spray paint and marking pens. Coating shall be suitable for application to painted and unpainted surfaces including masonry, concrete, metals, and stucco. Product shall be of type such that recoating with the underlying paint is possible without removal of the graffiti resistant coating. Product shall be a coating that dries clear, non-yellowing, with a low luster.
  - 1. Manufacturers:
    - a. Prosoco: Sure Klean ® Weather Seal Blok-Guard ® & Graffiti Control 15;  
www.prosoco.com.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.PRO Industrial Anti-Graffiti Coating: www.sherwin-williams.com.
  - 1. Permashield Premium 5600 over Aquaseal ME 12 by Monopole Inc.
  - 2. ND Graffiti Shield System by New Dimensions Solutions.
  - 3. VandlGuard System by Rainguard Pro.



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4. Or Approved Equal

### 2.2 GRAFFITI REMOVER:

- A. Manufacturer's standard graffiti remover or other product as recommended by the manufacturer.
- B. Non-caustic, biodegradable and recyclable, allowing graffiti removal without the use of blasting equipment, hot water, or high-pressure wash equipment.
- C. 100% biodegradable, suitable for vertical, porous and nonporous surfaces.
- D. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.3 MATERIAL

- A. Solvent based silicone elastomer masonry sealer formulated to weatherproof exterior masonry.
- B. Penetrates and fills pores to prevent water penetration through exterior walls exposed to normal weathering.
- C. Shall have UV stability and provide long-lasting protection against water penetration and many types of graffiti.
- D. Clear, colorless liquid which produces a water repellent effect without altering color or texture of substrate.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify all surfaces are ready to receive coating in accordance with manufacturer's printed requirements. Beginning of installation indicates acceptance of substrate.

### 3.2 PREPARATION

- A. Surface shall be free of dirt, dust, contaminants such as curing compounds, hardeners, bond breakers, and form release. Allow painted surfaces to cure properly. Do not water blast painted surfaces. Assure surfaces are clean and dry.
- B. Mask or otherwise protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces such as glass, remove immediately, by approved method.
- C. Protect landscaping, property, and vehicles from over spray and drift.

### 3.3 APPLICATION

- A. Apply coating in accordance with manufacturer's published instructions.
- B. Application Rate: Apply each coat at the manufacturers published application rate.

### 3.4 SURFACES TO BE COATED

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- A. Apply graffiti resistant coating to all exterior exposed building surfaces visible from the ground level, including concrete, masonry, sheet metal items, and stucco. Apply coating to painted and unpainted surfaces. Exclude horizontal surfaces subject to wheel or foot traffic.
- B. Apply to exterior non-building vertical surfaces including solid or semi-solid fencing, segmental block or concrete panel retaining walls, and masonry screening as applicable.
- C. On building surfaces, apply coating system full height building, (UNO) including exterior overhead or coiling door surfaces. Apply to top of building if no definitive continuous horizontal demarcation lines exist. Exclude wall and door surfaces behind fenced enclosures.

### 3.5 MAINTENANCE

- A. Deliver cleaning products to the Owner for storage and subsequent use for graffiti removal.
- B. Apply cleaning instructions label to interior wall location as directed by the Construction Manager.

### 3.6 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
  - 1. Contractor will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
  - 2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
    - a. Quantitative materials analysis.
    - b. Absorption
    - c. Accelerated weathering.
    - d. Accelerated yellowness.
    - e. Alkali and mildew resistance.
    - f. Abrasion resistance.
    - g. Washability.
  - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.
- B. Verify application rate by periodic on-site inspection and calculation of area covered compared to consumption of coating material used. Document inspections showing total area covered and number and volume of coating containers used.

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### 3.7 CLEANUP AND PROTECTION:

- A. During process of work, remove discarded coating materials, rubbish, cans, and rags at end of each workday.
- B. Protect work of other trades, whether to be coated or not, against damage by coating and finish work. Correct any damage by cleaning, repairing or replacing, and recoating, as acceptable to Architect.
  - 1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
  - 2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

**END OF SECTION 09 9600**

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**SECTION 10 1400  
SIGNAGE**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections apply to this Section.

**1.2 SECTION INCLUDES**

- A. All graphics and signage for the Project
  - 1. Room and door signs.
  - 2. Interior directional and informational signs.
- B. Building identification signs.
- C. Plaques.

**1.3 RELATED REQUIREMENTS**

- A. Section 015813 - Project Identification: Project Construction Signage
- B. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- C. Section 26 0553 - Identification for Electrical Systems.
- D. Section 26 5100 - Interior Lighting: Exit signs required by code.

**1.4 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 - General Requirements Specification Sections apply to this section.

**1.5 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.6 MINIMUM SIGN REQUIREMENTS**

- A. Permanent Rooms and Spaces:
  - 1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.

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2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
  3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
  4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
  5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
  6. Mounting Location and Height: As shown in drawings, mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.
- B. Overhead Signs:
1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
  2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
  3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
  4. Mounting Location and Height: As shown in Drawings.

### 1.7 SUBMITTALS

- A. See Section 013300 - Submittal Procedures, for submittal requirements.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  3. Submit for approval by Owner through Architect prior to fabrication.
- D. Shop Drawings: Show fabrication and installation details for signs.
  1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

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2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- G. Verification Samples: Submit samples showing colors specified.
- H. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- I. Closeout Submittals:
  1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.
  2. Submit warranty documents specified herein.

### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

### 1.9 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

### 1.11 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

### 1.12 WARRANTY

- A. See Section 01 78 36 - Warranties and Bonds; for additional warranty requirements.
- B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
  1. Warranty Period: One (1) year from Substantial Completion date.

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### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.
- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

#### 2.2 MATERIALS

- A. Aluminum Sheet Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
  - 1. Not less than 0.125 inch thick for face and 0.125 inch thick for returns.

#### 2.3 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
- C. Building Identification Signs:
  - 1. Use individual metal letters.
  - 2. Mount on outside wall in location indicated on drawings.
- D. Fire Extinguisher Cabinets: Cabinets and enclosed compartments used to house portable fire extinguishers shall be clearly marked with the words FIRE EXTINGUISHER in letters at least 2 inches (51 mm) high.
  - 1. Identify extinguishers and cabinets with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface

#### 2.4 PANEL SIGNS

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- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products to be incorporated into the Work include the following:
1. Approved Manufacturers:
    - a. ACE Sign Systems, Inc.
    - b. APCO Graphics, Inc.
    - c. ASI-Modulex, Inc.
    - d. Best Sign Systems Inc.
    - e. Nelson-Harkins Industries.
  2. Substitutions: Refer to Section 01 2500 - Substitution Procedures.
- B. Laminated Interior Signs: Solid phenolic panel core with graphic image covered with thermosetting resin face layer.
1. Surface Finish: Mat.
  2. Edge Condition: Beveled.
  3. Corner Condition: Square.
  4. Thickness: ¼ inch.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1.
1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
    - a. Panel Material: Opaque acrylic sheet.
    - b. Raised-Copy Thickness: Not less than 1/32 inch.
    - c. Font: Eurostyle
- D. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
1. Color: As selected by Architect from manufacturer's full range.

### 2.5 PLAQUES

- A. Refer to Section 015813 - Project Identification.

### 2.6 DIMENSIONAL LETTERS

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- A. Basis-of-Design Product: Subject to compliance with requirements, provide Series LF as manufactured by ASI Modulex, Inc. or a comparable product by one of the following:
1. Approved Manufacturers:
    - a. ACE Sign Systems, Inc.
    - b. Advance Corporation; Braille-Tac Division.
    - c. A. R. K. Ramos.
    - d. Bunting Graphics, Inc.
    - e. Charleston Industries, Inc.
    - f. Gemini Incorporated.
    - g. Grimco, Inc.
    - h. Innerface Sign Systems, Inc.
    - i. Metal Arts; Div. of L&H Mfg. Co.
    - j. Mills Manufacturing Company.
    - k. Mohawk Sign Systems.
    - l. Nelson-Harkins Industries.
    - m. Signature Signs, Incorporated.
  2. Substitutions: Refer to Section 01 2500 - Substitution Procedures.
- B. Fabricated Channel Characters: Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with the following requirements:
1. Aluminum Sheet: Not less than 0.125 inch thick for face and 0.125 inch thick for returns.
    - a. Finish: Brushed aluminum.
    - b. Font: Eurostyle.
- C. Exterior Signage: As indicated on drawings.
- D. Illuminated Characters: Illuminate characters face in manner indicated using manufacturer's standard lighting components, transformers, insulators, and other components. Make provisions for servicing and concealing connections to building electrical system. Coordinate electrical characteristics with those of power supply provided.

### 2.7 ACCESSORIES

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- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- B. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- C. Exposed Screws: Stainless steel.
- D. Tape Adhesive: Double sided tape, permanent adhesive.

### 2.8 FABRICATION

- A. General Provide manufacturer's standard signs of configurations indicated.
  - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
  - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
  - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
  - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

### 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### 2.10 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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- B. Verify that items, including anchor inserts, and electrical power are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected
- D. Verify that substrate surfaces are ready to receive work.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.
- E. Wall mount plaques shall be installed straight, level and true to the surface of the mounting area. The plaque shall be mounted in accordance with manufacturer's specification with concealed fasteners for the type of wall surface that the plaque is being mounted. Plaques shall be mounted so that the center of the plaque is located in five (5) feet above the finish grade or floor.

### 3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces per manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

**END OF SECTION 10 1400**

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**SECTION 10 2239  
FOLDING PANEL PARTITIONS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Top-supported folding panel partitions, horizontal opening.

**1.2 RELATED REQUIREMENTS**

**1.3 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- F. ASTM E413 - Classification for Rating Sound Insulation 2022.
- G. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions 2012 (Reapproved 2020).
- H. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures 2022.
- I. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.
- J. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

**1.5 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, track switching components, and colors and finishes available.
- C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in Nevada, showing loads at points of attachment to the building structure.

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- D. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.
- E. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.
- F. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Folding Panel Partitions - Horizontal Opening:

- 1. Basis of Design: Modernfold, a DORMA Group Company; \_\_\_\_: [www.modernfold.com/#sle](http://www.modernfold.com/#sle).

### 2.2 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

- A. Folding Panel Partitions: Center opening; paired panels; side stacking; motor operated.
- B. Panel Construction:
  - 1. Frame: 16 gauge, 0.0598 inch thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
  - 2. Substrate: Gypsum board.
  - 3. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
  - 4. Hinges: Continuous piano type, \_\_\_\_ gauge, \_\_\_\_\_ inch stainless steel.
  - 5. Hardware: Latching door handles of cast steel, satin chrome finish; lock cylinder keyed to building keying system; pull bars.
  - 6. Panel Properties:
    - a. Thickness With Finish: 4 inches.
    - b. Width: Standard width.
    - c. Weight: 8 lb/sq ft.
- C. Panel Finishes:

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1. Facing: Vinyl coated fabric.
  2. Exposed Metal Trim: Clear anodized.
- D. Panel Seals:
1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
  2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.
- E. Suspension System:
1. Track: Formed steel; 1-1/4 by 1-1/4 inch size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
  2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
- F. Performance:
1. Acoustic Performance:
    - a. Noise Reduction Coefficient (NRC): ASTM E596, NRC of 0.65 minimum.
    - b. Sound Transmission Class (STC): 38 to 42 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
  2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
  3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.
- G. Accessories:
1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments, and intermediate meeting posts.
  2. Pocket Enclosures: Door, frame, and trim to match adjacent walls.
  3. Acoustic Sealant: As recommended by partition manufacturer.

### 2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.
- C. Hardwood Plywood: Face species Beech, plain sliced, book matched, veneer core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1; glue type as recommended for application.

### Folding Panel Partitions - 10 2239

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- D. Particleboard: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.
- C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- D. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- E. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

#### **3.2 INSTALLATION**

- A. Install partition in accordance with manufacturer's instructions and ASTM E557.
- B. Fit and align partition assembly and pocket doors level and plumb.
- C. Lubricate moving components.
- D. Install acoustic sealant to achieve required acoustic performance.
- E. Coordinate electrical connections.

#### **3.3 ADJUSTING**

- A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.
- B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.
- C. Adjust partition assembly to achieve lightproof seal.

#### **3.4 CLEANING**

- A. Clean finish surfaces and partition accessories.

#### **3.5 CLOSEOUT ACTIVITIES**

- A. Demonstrate operation of partition and identify potential operational problems.

**END OF SECTION 10 2239**

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**SECTION 10 2601  
WALL AND CORNER GUARDS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections apply to this Section.

**1.2 SECTION INCLUDES**

- A. Corner Guards

**1.3 RELATED REQUIREMENTS**

- A. Section 05 5000 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.

**1.4 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

**1.5 SUBMITTALS**

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit two sections of corner guard, 12 inch long, illustrating component design, configuration, color and finish.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 10 years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Comply with NFPA 101® for interior finish materials. Smoke developed less than 450 and flame spread of 25 or less in accordance with ASTM E84.

**Wall and Corner Guards - 10 2601**

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### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly indicating manufacturer and material.
- B. Storage: Store materials indoors in a clean, dry area protected from damage and in accordance with manufacturer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Construction Specialties, Inc: [www.c-sgroup.com](http://www.c-sgroup.com).
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed. submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. Wall and Corner Guards:
    - a. Koroseal Wall Protection Systems; A Division of RJF International Corporation: (310)988-8520.
    - b. Arden Architectural Specialties, Inc: [www.ardenarch.com](http://www.ardenarch.com).
- C. Substitutions: Refer to Section 012500 - Substitution Procedures.

### 2.2 STAINLESS STEEL CORNER GUARDS:

- A. Stainless Steel:
  - 1. Stainless steel corner guards to be CS Acrovyn: Surface mounted guards to be 16 gauge stainless steel.
    - a. Type WG-1: Model CO-8: 90° stainless steel corner guard with 3/16" (4.8mm) radius and 3 1/2" (88.9mm) standard legs.
  - 2. Materials:
    - a. Stainless steel: To be type 304 alloy with #4 satin finish.
  - 3. Mounting: Surface Mounted
    - a. Mounted with construction adhesive standard.

#### Wall and Corner Guards - 10 2601

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- b. Hardware: Provide attachment hardware for complete and secure assembly. Flush mounted screws.
  - c. All necessary fasteners to be supplied by the manufacturer.
- 4. Height: As indicated on Drawings.
  - 5. Locations: As indicated on Drawings.

### 2.3 ACCESSORIES

- A. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
- B. Adhesive: Manufacturer recommended contact
- C. Wall backing: Provide horizontal backing . See Section 05 50 00 - Metal Fabrications for supply of anchor devices to be installed as work of this section.

### 2.4 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.

### 3.2 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations, using only approved adhesive or mounting hardware and locating all components firmly into position, level and plumb.
- B. Position corner guard 4 inches from top of base to 72 inches high.
  - 1. Provide Alternate: Run corner guard running to underside of finished ceiling.

### 3.3 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

### 3.4 CLEANING

## Wall and Corner Guards - 10 2601

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- A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.

**END OF SECTION 10 2601**

**Wall and Corner Guards - 10 2601**

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**SECTION 10 2800  
TOILET ROOM ACCESSORIES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections apply to this Section.

**1.2 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Diaper changing stations.
- D. Utility room accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealant around grab bars and accessories.
- B. Section 08 8300 - Mirrors: Other mirrors.
- C. Section 09 2216 - Non-Structural Metal Framing Sheet metal backing for accessories.

**1.4 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017 (Reapproved 2022).
- G. ASTM C1036 - Standard Specification for Flat Glass 2021.
- H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2022.

**Toilet Room Accessories - 10 2800**

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## City of Sparks - Fire Station #6

### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

### 1.6 SUBMITTALS

- A. See Section 013300 - Submittal Procedures, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

### 1.8 WARRANTY

- A. See Section 017836 - Product Warranties and Bonds, for additional warranty requirements.
- B. Manufacturer's Warranty for Washroom Accessories: Manufacturer's standard 1 year warranty for materials and workmanship.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Refer to Drawings - Toilet Accessory Schedule and Interior Elevations.
- B. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Basis of Design: Bobrick Washroom Equipment, Inc..
- C. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
  - 1. American Specialties, Inc: [www.americanspecialties.com](http://www.americanspecialties.com).
  - 2. Bradley Corporation: [www.bradleycorp.com](http://www.bradleycorp.com).
- D. Substitutions: 012500 - Substitution Procedures.
- E. Provide products of each category type by single manufacturer.

### Toilet Room Accessories - 10 2800

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### 2.2 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide 6 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### 2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

### 2.4 COMMERCIAL TOILET ACCESSORIES

- A. Refer to Drawings - Toilet Accessory Schedule and Interior Elevations.
- B. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Refer also to Section 08 8300 - Mirrors.

### 2.5 ADA PIPING PROTECTION SYSTEMS

- A. Undersink Piping Protective Covers:

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1. General: Comply with requirements of (ADAAG), ANSI/ICC A117.1, and as follows:
  - a. Contractor to provide one of the following types.
  - b. Lavatory P-traps and angle valve assemblies shall be covered with undersink protective pipe cover assemblies.
    - 1) Cover assemblies shall include P-trap cover, two angle valve covers, offset grid drain cover, tailpiece cover, and extensions as necessary to cover all undersink piping and valves.
  - c. Covers shall be secured with snap-clip flush reusable fasteners, and angle stop shall have locking access cover. Cable ties or baggie tie fasteners are not acceptable.
  - d. Covers shall be installable and removable without requiring disassembly of P-trap or angle stop.
  - e. Covers shall allow for emergency and maintenance access to the plumbing P-trap clean-out and angle stop valve without removing piping covers.

**B. Undersink Piping Protective Covers - Type T- 29 : Product: Lav Guard 2.**

1. Material: Soft, resilient molded vinyl.
2. Nominal Wall Thickness : 1/8" constant with internal ribs.
3. UV Protection: Will not fade or discolor.
4. Durability : Virtually indestructible.
5. Color: China white.
6. Compatibility #100 E-Z Series Fits all 1-1/4" or 1-1/2" cast brass or tubular P-trap assemblies and 3/8" or 1/2" angle stop assemblies.
7. Compatibility #400\* Series Fits all 1-1/2" schedule 40 plastic P-traps.
8. Paintability: Apply latex paint.
9. Burning Characteristics: Self extinguished 0 sec (ATB) mm (AEB).  
(ASTM D-635)
10. Bacteria/Fungus Resistance ASTM G21 — Result: 0 growth.

**OR**

**C. Undersink Piping Protective Covers - Type T- 29a : Product: Soft Guard Plus.**

1. Provide under sink pipe protection to all drainage piping including hot and cold water valves and supplies under lavatories to meet ADA compliance.
2. Material: 1/8" Pliable PVC Shell Finish.

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3. 1-1/2" Schedule 40 Plastic with Swivel Nuts.
  4. Furnished custom fit snap-to-lock fasteners may be used for improved tamper resistance.
  5. Burning Characteristics: PVC Base Insulation Material complies with 25 Flame Spread/450 Smoke Index.
  6. Bacteria/Fungus Resistance ASTM G21 — Result: 0 growth.
- D. Basis of Design Manufacturer: TrueBro, Inc.; 7 Main Street, Ellington, CT 06029; Tel. 860-875-2868 or 800-340-5969; Fax. 860-872-0300; internet:www.truebro.com.
1. TrueBro Lav-Guard Undersink Protective Pipe Covers.
- E. Substitutions: See Section 01600 - Product Requirements.

### 2.6 COMMERCIAL SHOWER AND BATH ACCESSORIES

- A. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
1. Seat: Closed-cell foam rubber with vinyl-coated fabric cover, with sealed seams, of White color.
  2. Configuration: L-shaped seat, designed for wheelchair access.
  3. Size: ADA Standards compliant.
  4. Dimensions: 33" wide and projects 22 5/16" from wall.

### 2.7 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Stainless steel.
  2. Mounting: Surface.
  3. Color: Gray.
  4. Minimum Rated Load: 250 pounds.
  5. Products:
    - a. Basis of Design: Koala Kare Products.
- B. Accessories: Liners For Diaper Changing Station.

### 2.8 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.



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1. Holders: Three spring-loaded rubber cam holders.
2. Length: 36 inches.
- B. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  1. Drying rod: Stainless steel, 1/4 inch diameter.
  2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
  3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  4. Length: 36 inches.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Sections 05 50 00 or 09 22 16 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

#### 3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

#### 3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate in locations and at heights indicated on Drawings.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

#### 3.4 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.

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C. Clean and polish exposed surfaces according to manufacturer's written recommendations

**3.5 PROTECTION**

A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION 10 2800**

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**SECTION 10 4313  
AUTOMATED EXTERNAL DIFIBRILLATOR AED & CABINET**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Automated External Defibrillator (AED)
- B. AED cabinet and accessories.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit drawings showing cabinet exterior and interior dimensions, defibrillator mounting, corner sections, hinge arrangement and hardware.
- B. Product Data: Submit product data for AED and all components.
- C. Operation and Maintenance Data:
  - 1. Submit operation and maintenance data for installed products.
  - 2. Include: Manufacturer's instructions covering maintenance requirements and parts catalog, giving complete list of repair and replacement parts with cuts and identifying numbers.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Requirements.
  - 1. International Building Code (IBC), 2012 Edition with Southern Nevada Amendments.
  - 2. 2010 ADA Standards for Accessible Design.

**1.4 DELIVERY, STORAGE & HANDLING**

- A. Deliver materials in manufacturer's original packaging with identification labels intact.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Philips.

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B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. J. L. Industries, Inc., a division of Activar Construction Products Group;
2. Larsen's Manufacturing Company;

C. Substitutions: 012500 - Substitution Procedures.

### 2.2 AUTOMATIC EXTERNAL DEFIBRILLATOR (AED)

- A. Basis of Design: Phillips "HeartStart FRx" Defibrillator.
- B. For treatment of sudden cardiac arrest.
- C. Lightweight, portable construction for exterior use in extreme temperatures, dust, and wet environments.
- D. Usable for both adults and children.
- E. Provides voice commands and instructions.
- F. Capable of four (4) years between battery replacement.
- G. Provide carrying case and wall-mounted storage cabinet.

### 2.3 AED CABINET

- A. Cabinet Type: Suitable for mounting and enclosing specified AED.
- B. Style: Exterior, Surface-Mounted.
- C. Cabinet Material:
  1. 20 gauge cold rolled steel with smooth white powder coat paint finish.
  2. Continuous hinges that allow 180 degree door opening.
  3. Magnetic door catch with handle built in to door.
  4. Clear acrylic glazing pre-installed in cabinet.
- D. Accessories: Provide manufacturers standard anchors recommend for substrate.

### 2.4 IDENTIFICATION

- A. Identify defibrillator cabinets in accordance with ANSI/NFPA 10 using manufacturers standard identification method
- B. Provide 3-way wall sign above cabinet.

## Automated External Defibrillator AED & Cabinet - 10 4313

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### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- A. Layout location of cabinets as indicated on drawings and in conjunction with adjacent construction.
- B. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of defibrillator cabinet materials.

#### **3.2 INSTALLATION**

- A. Coordinate installation with the manufacturer's written installation details and instructions.
- B. Install defibrillator cabinets as indicated.
- C. Installation heights for cabinets shall comply with 2010 ADA Standards for Accessible Design.
- D. Arrange equipment so that removal for repairs or replacement does not require undue dismantling or removing of other equipment components.
- E. Coordinate defibrillator cabinet work with work of other trades for proper time and sequence to avoid construction delays.
- F. Delay installation of AED until Substantial Completion.

#### **3.3 ADJUSTMENT**

- A. Adjust defibrillator cabinet doors to achieve smooth operation.

#### **3.4 DEMONSTRATION**

- A. Install defibrillator and ensure full charge on integral battery
- B. After installation of defibrillator, Schedule instruction session with Owner's representative.
- C. Instruct Owner's designated maintenance personnel in care, adjustment and operation of defibrillator.

#### **3.5 PROTECTION**

- A. Protect installed products from damage during remainder of construction.

**END OF SECTION 10 4313**

**Automated External Defibrillator AED & Cabinet - 10  
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**SECTION 10 4400  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.
- D. Knox Boxes

**1.2 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.3 REFERENCE STANDARDS**

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2023a.
- B. FM (AG) - FM Approval Guide Current Edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- D. UL (DIR) - Online Certifications Directory Current Edition.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Size: 6 by 6 inches (150 by 150 mm) square.
- E. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.5 COORDINATION**

**Fire Protection Specialties - 10 4400**

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- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

### 1.6 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Fire Extinguishers:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).
  - 3. Or Approved Equal.
- B. Fire Extinguisher Cabinets and Accessories:
  - 1. Basis of Design: Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

### 2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
  - 2. Class: 5E; 3A-40BC type.
  - 3. Size: 5 pound.
  - 4. Monoammonium phosphate-based dry chemical.
  - 5. Finish: Baked polyester powder coat, red color.

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6. Valves: Manufacturer's standard.
7. Handles and Levers: Manufacturer's standard.
8. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
9. Temperature range: Minus 40 degrees F to 120 degrees F.

### 2.3 FIRE EXTINGUISHER CABINETS - (JR INDUSTRIES)

- A. Type FEC-2: Cabinet Configuration: Semi-recessed type.
  1. Basis of Design: Ambassador Series.
  2. Model #: 1816.
  3. Door Style: Style W: Vertical Duo Panel with SAF-T-LOK™; narrow vertical glazing full height of door; theft-deterrent, pull handle.
  4. Trim Style and Depth: Semi-recessed Cabinet:
    - a. Square Edge: 1-1/2 inch (38.10 mm)
  5. Door and Trim Construction:
    - a. Cold-rolled steel with white powder-coated finish standard. Flush cabinet doors with a 5/8" door stop are attached by a continuous hinge and equipped with zinc-plated handle and roller catch. All models have 1-3/4" wide trim on frame and 1-1/4" trim on doors with glazing.
    - b. Finish:
      - 1) Standard Color: White.
    - c. Finish of Cabinet Interior: White enamel.
  6. Door Glazing: Type 10: Clear acrylic.
  7. Tub: The tub is constructed of CRS with white powder-coat finish standard.
  8. Cabinet Mounting Hardware: Pre-drill for anchors.
  9. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
    - a. Provide ADA flush door pull and friction latch.
    - b. Provide manufacturer's standard hinge permitting door to open 180 degrees.
  10. Weld, fill, and grind components smooth.
- B. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire-resistance rating of wall where it is installed. Construct fire-rated cabinets with double walls fabricated from 0.0478



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inch (1.2-mm) thick, cold-rolled steel sheet lined with minimum (16-mm) thick, fire-barrier material. Provide factory drilled mounting holes.

### 2.4 ACCESSORIES

- A. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
  - 1. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
    - a. Location: Applied to cabinet door.
    - b. Application Process: Pressure-sensitive vinyl letters.
    - c. Lettering Color: Red.
    - d. Orientation: Vertical.
- C. Extinguisher Brackets: Formed steel, chrome-plated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level, 60 inches from finished floor to the top of the extinguisher, or as indicated on Drawings.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Wall Signs:
  - 1. Location: Where shown or directed.
  - 2. Apply on walls after field painting is completed and has been accepted.
- F. Position cabinet signage as indicated.

### 3.3 MAINTENANCE - SELF-SERVICE FIRE EXTINGUISHERS

**City of Sparks - Fire Station #6**

- A. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).
- B. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

**END OF SECTION 10 4400**

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**SECTION 10 7500  
FLAGPOLES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Aluminum Flagpoles.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

**1.3 REFERENCE STANDARDS**

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains 2016 (Reapproved 2020).
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2022.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles 2007.

**1.4 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

**1.5 QUALITY ASSURANCE**

- A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Nevada.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
  - 1. Concord American Flagpole; Internal - Titan: [www.concordamericanflagpole.com/#sle](http://www.concordamericanflagpole.com/#sle).
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

**Flagpoles - 10 7500**

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1. Morgan-Francis Flagpoles & Accessories: [www.morgan-francis.com/#sle](http://www.morgan-francis.com/#sle).
  2. Pole-Tech Co, Inc: [www.poletch.com/#sle](http://www.poletch.com/#sle).
- C. Substitutions: See Section 01 2500 - Substitution Procedures.

### 2.2 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001
1. Concord American Flagpole Model #: ICC25C61-SAT
  2. Material: Aluminum.
    - a. Finish: SAT - Satin Aluminum Finish.
  3. Design: Cone tapered.
  4. Mounting: Ground mounted type.
  5. Outside Butt Diameter: 8 inches.
  6. Outside Tip Diameter: 3.5 inches.
  7. Nominal Wall Thickness: 0.250 inches.
  8. Nominal Height: 25 ft; measured from nominal ground elevation.
  9. Halyard: Internal type, manual winch operation.
    - a. Winches For Use With Wire Based Internal Halyard Systems:
- B. Performance Requirements:
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 126 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

### 2.3 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

### 2.4 ACCESSORIES

- A. Flag: USA design, 5 ft by 8 ft size, nylon fabric, brass grommets, hemmed edges.
1. Part Nos.: FLG-0508N-US.
- B. Complete Internal Halyard Wire Cable Assembly:
1. Heavy Duty Flag Arrangement: Containing:
    - a. Wire Cable Assembly: 5/16" - Polyester Wire Core #10.

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- b. Shock Spring w/ Shock Spring Safety Cable: 4-1/2" HD Stainless Steel (2); Part No.: FSA-1015.
    - 1) Shock Spring Safety Cable: Part No. SPR-0100.
  - c. Retainer Ring Assembly: 1" Ball / 2" Roller; Part No.: RRA-0H10-WHT.
  - d. Counterweight: Provide proper choice of counterweight based on wind zone and flag size flown.
  - e. Stainless Steel Connecting Link: 5/16" Stainless Steel; Part No.: LNK-0300.
- C. 1-Piece Construction Heavy-duty Cast Aluminum Collar:
- 1. Style B - FC11 Spun Alum 1-Piece.
    - a. Part No.: COL1-A06S.
- D. Ground Sleeves - Steel Corrugated Steel with Steel Lightning Spike Two-Piece Design.
- 1. Part No.: GCA-2510.
  - 2. Lightning Rod Kit: Part No.: LRK-9019 .
- E. Lighting: Internal Halyard Beacon - Dual Light Winch System - Rope Halyard.
- 1. BEACON - Dual Light
    - a. Part No.: ABW2-25FS-SAT.

### 2.5 OPERATORS

- A. Hand Crank: Removable handle type.

### 2.6 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth of 30 inches as indicated.
- B. Pole Base Attachment: Flush; steel base with base cover.
- C. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

### 2.7 FINISHING

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.
- B. Aluminum: Mill finish.
- C. Finial: Clear anodized finish.

## PART 3 EXECUTION

### 3.1 EXAMINATION

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- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available and of the correct characteristics.

### 3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

### 3.3 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Fill foundation tube sleeve with concrete specified in Section 03 3000.
- D. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.
- E. Coordinate installation of conduit and boxes from disconnect to control unit and control unit to motor operating device.

### 3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

### 3.5 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

**END OF SECTION 10 7500**

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**SECTION 12 2400  
WINDOW SHADES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Manual roller shades and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of shade brackets and accessories.

**1.3 REFERENCE STANDARDS**

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2023, with Errata.
- C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.
- D. WCMA A100.1 - Standard for Safety of Window Covering Products 2022.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- B. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with finished conditions in place. "Hold to" dimensions are not acceptable.
  - 2. Do not install shades until final surface finishes and painting are complete.

**1.5 SUBMITTALS**

- A. See Section 01 3300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- D. Selection Samples: Include fabric samples in full range of available colors and patterns.
- E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

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- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual locations of control system components and show interconnecting wiring.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum ten years of documented experience with shading systems of similar size, type, and complexity; manufacturer's authorized representative.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

### 1.8 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

### 1.9 WARRANTY

- A. See Section 01 7836 - Warranties and Bonds, for additional warranty requirements.
- B. Provide manufacturer's standard, non-depreciating warranty, for interior shading only, covering the following:
  - 1. Shade Hardware: 10 years unless otherwise indicated.
  - 2. EcoVeil® Screens – 10 years with MS hardware, fabricated by MS.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: MechoShade Systems LLC; [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
- B. Other Acceptable Manufacturers:
  - 1. Or Approved Equal.
  - 2. Products by listed manufacturers are subject to compliance with specified requirements.
- C. Substitutions: Refer to Section 01 2500 - Substitution Procedures.



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1. Products other than basis of design are subject to compliance with specified requirements and prior approval of Architect. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

### 2.2 ROLLER SHADES

#### A. General:

1. Provide shade system components that are capable of being removed or adjusted without removing mounted shade brackets or cassette support channel.
2. Provide shade system that operates smoothly when shades are raised or lowered.

#### B. Roller Shades Type WC-1 - Basis of Design: MechoShade Systems LLC; [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).

1. Description: Double roller, manually operated fabric window shades.
  - a. Provide universal drive capability to offset drive chain for reverse roll or regular roll shades.
  - b. Drop Position: Regular roll.
  - c. Mounting: Window jamb mounted.
  - d. Size: As indicated on drawings.
  - e. Fabric: As indicated under Shade Fabric article.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
  - a. Model: Mecho® SlimLine™.
  - b. Material: Steel, 1/8 inch thick.
  - c. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
    - 1) Light-Filtering Fabric: Room-side of opening.
    - 2) Room-Darkening Fabric: Glass-side of opening.
3. Roller Tubes:
  - a. Material: Extruded aluminum.
  - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
  - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.

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- d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
- 4. Hembars: Designed to maintain bottom of shade straight and flat.
  - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
  - b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
- 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
  - a. Provide a permanently lubricated brake assembly mounted on a oil-impregnated hub with wrapped spring clutch.
  - b. Brake must withstand minimum pull force of 50 pounds in the stopped position.
  - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
- 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound minimum breaking strength. Provide upper and lower limit stops.
  - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
- 7. Accessories:
  - a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
    - 1) Fascia to be capable of installation across two or more shade bands in one piece.
    - 2) Provide single fascia to accommodate regular roll shades.
    - 3) Color: Anodized Aluminum.
    - 4) Profile: Square.
    - 5) Configuration: Captured, fascia stops at captured bracket end.
  - b. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.

### 2.3 SHADE FABRIC

- A. Fabric - Type SF-1: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
  - 1. Material Composition:
    - a. SH-1: 100% Thermoplastic Olefin (TPO).

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2. Performance Requirements:
  - a. Flammability: Pass NFPA 701 large or small scale test.
  - b. Fungal Resistance: No growth when tested according to ASTM G21.
3. Openness Factor: 5%, nominal.
4. Color: As indicated on Drawings.
5. Fabrication:
  - a. Provide welded zipper edge full height on both sides of fabric to ensure smooth operation within ShadeLoc channels.
6. Basis of Design Products:
  - a. Type SF-1 : MechoShade Systems LLC Inc; EcoVeil Screens - 1350 Series (5% open): [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).
  - b. for Room-Darkening Shades: MechoShade Systems LLC Inc; Classic Blackout 0700 Series (opaque): [www.mechoshade.com/#sle](http://www.mechoshade.com/#sle).

### 2.4 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
  1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
  3. Horizontal Dimensions - Outside Mounting: Extend shades 2 inches beyond jambs on each side.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

### 3.2 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

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### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

### 3.4 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

### 3.5 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Procedures and Submittals, for closeout submittals.

### 3.6 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION 12 2400**



**Specification Project Manual**  
**Volume 2**  
**City of Sparks Fire Station #6**  
**for**  
**City of Sparks Community Services**



**Bid Set**  
**Issue Date: January 04, 2024**

PREPARED BY

**tsk**

**TSK Architects**

225 Arlington, Suite A • Reno NV 89501

775.857.2949

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**SECTION 22 0500  
BASIC PLUMBING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

**1.2 SCOPE OF WORK**

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Scope of Work:
  - 1. Plumbing Work shall include, but is not necessarily limited to:
    - a. Furnish and install all items listed in the Plumbing Material List.
    - b. Furnish and install a new domestic water service to the building.
    - c. Furnish and install water meter and domestic water backflow preventer as required by Code.
    - d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
    - e. Furnish and install complete gas piping system including all meter requirements.
    - f. Furnish and install water softener.
    - g. Furnish and install water heaters.
    - h. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
    - i. Furnish and install all fire hydrants and associated piping, valves, and supports including connection to the water main.
    - j. Furnish and install makeup water connection to hydronic heating and/or cooling systems including reduced pressure principle type backflow preventer.
    - k. Furnish and install complete storm water drainage system.

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- l. Furnish and install storm water sump pumps and basins.
  - m. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
  - n. Furnish and install site storm water piping, cleanouts, and manholes.
  - o. Furnish and install complete sanitary sewer and vent system.
  - p. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 22 0550.
  - q. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - r. Complete all applicable tests, certifications, forms, and matrices.
2. Heating Work: Refer to Section 23 0500 - Basic HVAC Requirements.
  3. Air Conditioning and Ventilating Work: Refer to Section 23 0500 - Basic HVAC Requirements.
  4. Temperature Control Work: Refer to Section 23 0500 - Basic HVAC Requirements".
  5. Fire Protection Work: Refer to Section 21 0500 - Basic Fire Suppression Requirements.
  6. Testing, Adjusting, and Balancing Work: Refer to Section 23 0500 - Basic HVAC Requirements.

### 1.3 OWNER FURNISHED PRODUCTS

- A. The Owner will supply the following items for installation and/or connection by this Contractor:
- B. The following items shall be relocated, installed and/or connected by this Contractor:
- C. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.
- D. This Contractor shall make all plumbing system connections shown on the drawings or as required for fully functional units.
- E. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

### 1.4 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
  1. "Mechanical Contractors" refers to the following:
    - a. Plumbing Contractor.
    - b. Heating Contractor.
    - c. Air Conditioning and Ventilating Contractor.

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- d. Temperature Control Contractor.
  - e. Fire Protection Contractor.
  - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
  3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
  4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
  5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
    - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
  6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
  7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

**B. General:**

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

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2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
  3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
  4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
  5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
    - a. Light fixtures.
    - b. Gravity flow piping, including steam and condensate.
    - c. Electrical busduct.
    - d. Sheet metal.
    - e. Electrical cable trays, including access space.
    - f. Sprinkler piping and other piping.
    - g. Electrical conduits and wireway.
- C. Mechanical Contractor's Responsibility:
1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
    - a. Boiler Feed Pumps.
    - b. Burners.
    - c. Chillers.
    - d. Computer Room Air Conditioning Units.
    - e. Condensate Return Stations.
    - f. Condensing Units.
    - g. Makeup Air Units.
    - h. Electric Humidifiers.
    - i. Gas Trains.



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- j. Package Air Handling Units.
  - k. Packaged Rooftop Units.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
  3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
  4. Temperature Control[[Contractor's] Responsibility:
    - a. Wiring of all devices needed to make the Temperature Control System functional.
    - b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control [Contractor].
    - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
  5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
  2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control [Contractor] when so noted on the Electrical Drawings.
  3. Provides motor control and temperature control wiring, where so noted on the drawings.
  4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
  5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
  6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

### 1.5 COORDINATION DRAWINGS

- A. Definitions:

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1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
  - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

### B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the [Mechanical Contractor][Insert].
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's

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use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

### C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).
    - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
    - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
    - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
    - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

### D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

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6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

Referenced Specification Section	Submittal Item
22 05 00	Owner Training Agenda
22 05 03	Fire Seal Systems
22 05 13	Motors
22 05 15	Variable Frequency Drives
22 05 16	Expansion Compensation
22 05 29	Hangers and Supports
22 05 48	Vibration Isolation Equipment
22 05 50	Seismic Restraint Systems
22 05 53	Plumbing Identification
22 07 16	Plumbing Equipment Insulation

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22 07 19	Plumbing Pipe Insulation
22 09 00	Instrumentation
22 10 00	Plumbing Piping Systems and Valves
22 10 23	Natural Gas and Propane Piping Systems
22 10 30	Plumbing Specialties
22 11 23	Domestic Water Pumps
22 15 19	Compressed Air Systems
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

### 1.6 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

### 1.7 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
  - 1. Fire Seal Systems
  - 2. Seismic Restraints and Equipment Bracing
- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

### 1.8 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

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- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

### 1.9 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

### 1.10 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

### 1.11 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.

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- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 JOBSITE SAFETY**

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

#### **3.2 EXCAVATION, FILL, BACKFILL, COMPACTION**

##### A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

##### B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.

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7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
  8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.
- C. Dewatering:
1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
  2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.
- E. Fill and Backfilling:
1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding [ or ] [ CA6 crushed stone ]. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
  2. Envelope around utilities to 6" above utilities: Place and compact sand [ or ] [ CA6 ] to a height of 6" over utilities in 6" layers. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
  3. Backfill from 6" above utilities to earthen grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
  4. Backfill from 6" above utilities to below slabs or paved area: Where the fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
  5. Backfill Materials: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Backfill material shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Water shall not be permitted to rise in unbackfilled trenches.
  6. Dispose of excess excavated earth as directed.
  7. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.



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8. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

### F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

### 3.3 SYSTEM STARTING AND ADJUSTING

- A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.
- C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### 3.4 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

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- C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.
- D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

### 3.5 PAINTING

- A. This Contractor shall paint the following items:
  - 1. All piping in mechanical room
  - 2. Piping exposed in kitchen
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

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- H. Paint all outdoor exposed [natural gas] piping the color selected by Owner or Architect/Engineer.
- I. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
  - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
  - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
  - 3. Color of paint shall be as follows:
    - a. All piping in mechanical room:
      - 1) Domestic Cold Water: Blue pipe/white letters
      - 2) Domestic Hot Water: Red pipe/white letters
      - 3) Sanitary Waste: Green pipe/black letters
      - 4) Natural Gas: Yellow pipe/black letters
    - b. Piping exposed in kitchen:
      - 1) All Piping: White

### 3.6 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### 3.7 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

### 3.8 READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

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- A. To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.
1. 1. Penetrations fire sealed and labeled in accordance with specifications.
  2. 2. All pumps operating and balanced.
  3. 3. All plumbing fixtures installed and caulked.
  4. 4. Pipe insulation complete, pipes labeled and valves tagged.
  5. 5. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

**END OF SECTION 22 0500**

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**SECTION 22 0503  
THROUGH PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2018 International Building Code
- J. NFPA 5000 - Building Construction Safety Code

**1.2 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

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- C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E84.

**1.4 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

**1.5 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

**PART 2 - PRODUCTS**

**2.1 THROUGH PENETRATIONS:**

*Alternate method of firestopping is patching opening to match original rated construction.
*Alternate method of firestopping is patching opening to match original rated construction.
*Alternate method of firestopping is patching opening to match original rated construction.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

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### 3.2 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.3 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

**END OF SECTION 22 0503**

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**SECTION 22 0513  
MOTORS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Single Phase and Three Phase Electric Motors.

**1.2 REFERENCES**

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. Energy Independence and Act of 2007.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

**1.4 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

**PART 2 - PRODUCTS**

**2.1 GENERAL CONSTRUCTION AND REQUIREMENTS**

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460



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- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- G. Each contractor shall set all motors furnished by him.
- H. All motors shall have a minimum service factor of 1.15.
- I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- K. Aluminum end housings are not permitted on motors 15 HP or larger.
- L. Motor Driven Equipment:
  - 1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
  - 2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.
- M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.
- N. Motors for pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control.

### 2.2 ELECTRICALLY COMMUTATED MOTORS (ECM)

- A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.

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- B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.
- C. All EC motors shall be a minimum of 85% efficient at all speeds.
- D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.
- E. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.
- F. Operational mode shall be as scheduled and shall be one of the following:
  - 1. Constant Flow
  - 2. Constant Temperature
  - 3. Constant Pressure

HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0
25.0	93.0	93.6	91.7	93.0	93.6	91.7
30.0	93.6	94.1	91.7	93.0	93.6	91.7
40.0	94.1	94.1	92.4	94.1	94.1	92.4
50.0	94.1	94.5	93.0	94.1	94.5	93.0
60.0	94.5	95.0	93.6	94.5	95.0	93.6
75.0	94.5	95.0	93.6	94.5	95.4	93.6
100.0	95.0	95.4	93.6	95.0	95.4	94.1
125.0	95.0	95.4	94.1	95.0	95.4	95.0
150.0	95.4	95.8	94.1	95.8	95.8	95.0
200.0	95.4	95.8	95.0	95.8	96.2	95.4
250.0	95.4	95.8	95.0	95.8	96.2	95.8
300.0	95.4	95.8	95.4	95.8	96.2	95.8
350.0	95.4	95.8	95.4	95.8	96.2	95.8
400.0	95.8	95.8	95.8	95.8	96.2	95.8
450.0	96.2	96.2	95.8	95.8	96.2	95.8
500.0	96.2	96.2	95.8	95.8	96.2	95.8

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### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

**END OF SECTION 22 0513**

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**SECTION 22 0516  
PLUMBING EXPANSION COMPENSATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Expansion Joints and Compensators.
- B. Pipe Loops, Offsets, and Swing Joints.

**1.2 REFERENCES**

- A. Conform to Standards of Expansion Joint Manufacturer's Association.

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 220500.
- B. Expansion joint shop drawings shall include maximum motion.

**1.4 DESIGN CRITERIA**

- A. Unless noted otherwise, base expansion calculations on 50°F installation temperature to 140°F for domestic hot water, plus 30% safety factor.

**PART 2 - PRODUCTS**

**2.1 EXPANSION JOINTS**

- A. Type EJ-1:
  - 1. Multiple plies of 300 series stainless steel bellows.
  - 2. Rated for 150 psi working pressure at 250°F and 100psi at 400°F.
  - 3. Cycle life shall be at least 1,000 full range (compression and extension) cycles at rated stroke and 6,000 cycles at 1/2 rated stroke.
  - 4. Axial motion shall be as scheduled on the drawings, but not less than 2" (compression plus extension).
  - 5. Provide removable metal insulation shroud around the bellows.
  - 6. Joints 2" or smaller in copper piping systems shall have all copper, brass or bronze construction with stainless steel bellows and union ends or sweat ends with unions added.
    - a. Manufacturers:
      - 1) American BOA Type KH
      - 2) Hyspan Type 8509

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- 3) Flexonics Model HB
  - 4) Metraflex Model HPMF
  - 5) Keflex Series 7QT
7. Joints 2" or smaller in ferrous piping systems shall have steel bodies with union ends or male threaded ends with unions added.
- a. Manufacturers:
    - 1) American BOA Type B
    - 2) Hyspan Type 8503
    - 3) Flexonics Model H
    - 4) Metraflex Model HP Keflex Series 7Q-MPT
8. Joints 2-1/2" or larger shall have 150 lb. forged steel flanges.
- a. Manufacturers:
    - 1) American BOA Model 3150FS or 3150FL
    - 2) Hyspan Model 1501
    - 3) RM Model X-Flex-150 Multiply
    - 4) Keflex Series 311-1215
    - 5) Metraflex Model MNLC
- B. Type EJ-4:
1. Assembly consisting of two flexible connectors, two stainless steel flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
  2. Connectors shall have corrugated stainless hose bodies with stainless steel braided casings.
  3. Connectors shall be rated for 150 psi working pressure at 70°F and 100 psi at 800°F.
  4. Sizes 2" and smaller shall have steel threaded connections.
  5. Sizes 2-1/2" and larger shall have 150 lb. steel flanges.
  6. Connectors shall be suitable for 1/2" permanent misalignment.
    - a. Manufacturer:
      - 1) Metraflex Type ML
- C. Type EJ-5:

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1. Plastic storm, waste and vent expansion joint. Pipe within a pipe arrangement with [6" (+/-3")][12" (+/-6")] total travel.
2. Connectors shall have EPDM (PVC pipe) or FKM (CPVC) O-ring seal used to seal telescoping sections.
3. Solvent weld or fused connections to match piping material specification.
4. Rated for up to 140°F (PVC pipe) or 180°F (CPVC).
  - a. Manufacturer:
    - 1) Flexicraft P or CP

### D. Alignment Guides:

1. Bolted semi-steel spider.
2. Bolted guiding cylinder with supporting legs welded to pipe support.
3. Sized to allow insulation to pass through the outer cylinder.
  - a. Manufacturers:
    - 1) American BOA
    - 2) Hyspan, Flexonics
    - 3) Keflex
    - 4) Metraflex

### E. Concrete Thrust Blocks - Rods and Clamps:

1. Bends, offsets, tees, crosses, and dead ends, including flange and spigot pieces, shall be suitably rodded or clamped and blocked with concrete thrust blocks.
2. Rods shall be all thread type, galvanized steel conforming to ANSI B1.1, Class 2A FIT, USS National Coarse Thread, tensile strength 55/77 ksi, yield strength 36 ksi minimum.
3. Rods and clamps shall receive one field coat of asphaltum after installation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Accomplish structural work and provide equipment required to control expansion and contraction of piping; including loops, offsets, swing joints, and expansion joints where required.
- B. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so all movement occurs along axis of pipe only.

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- C. Each expansion joint shall have either one anchor or two alignment guides on each side of it. Guides shall be located within 4 and 14 pipe diameters of the expansion joint or as recommended by the joint manufacturer.
- D. Preset all expansion joints to allow for expected expansion from installation temperature to operating temperature.

**END OF SECTION 22 0516**

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**SECTION 22 0529  
PLUMBING SUPPORTS AND ANCHORS**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

**1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS**

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

**PART 2 - PRODUCTS**

**2.1 SEISMIC RESTRAINTS**

- A. Refer to Section 220550 for additional requirements for seismic restraints.

**2.2 HANGER RODS**

- A. Hanger rods for single rod hangers shall conform to the following:

Column #1: Steel, cast iron, and glass pipe.
--

Column #2: Copper and plastic pipe.
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- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
- D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

**2.3 PIPE AND STRUCTURAL SUPPORTS**

- A. General:

- 1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
- 2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.



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3. Copper piping located in an exposed area, including indirect waste piping in [kitchens][ and][ janitor's closets], shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

- a. Products:

- 1) Erico/M-Co Model #456
- 2) B-Line Fig. 3198HCT
- 3) Anvil Fig. CT138R
- 4) Nibco/Tolco Fig. 301CT

- B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

- a. Products:

- 1) Cooper/B-Line Fig B3373 Series
- 2) Erico 510 Series
- 3) Nibco/Tolco Fig. 82

2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

- a. Products:

- 1) Mason RBA, RCA or RDA
- 2) Mason BR

3. Cold Pipe Alternative: Insulated pipe riser clamp with no thermal bridging between clamp and pipe; water repellent calcium silicate insulation material adhered inside the clamp; ASTM A653 galvanized steel clamp.

- a. Products:

- 1) Pipeshields E100

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4. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

### C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
5. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

#### a. Products:

- 1) Anvil Fig. 160, 161, 162, 163, 164, 165
  - 2) Cooper/B-Line Fig. 3160, 3161, 3162, 3163, 3164, 3165.
  - 3) Erico Model 630, 631, 632, 633, 634, 635.
  - 4) Nibco/Tolco Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4
6. Unless otherwise indicated, hangers shall be as follows:
    - a. Clevis Type:
      - 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller
      - 2) Products: Bare Steel Plastic or Insulated Pipe:
        - (a) Anvil Fig. 260
        - (b) Cooper/B-Line Fig. 3100
        - (c) Erico Model 400

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- (d) Nibco/Tolco Fig. 1
- 3) Products: Bare Copper Pipe:
  - (a) Cooper/B-Line Fig. B3100C
  - (b) Nibco/Tolco Fig. 81PVC
- b. Roller Type:
  - 1) Service: Insulated Hot Pipe - 4 inches and Larger
  - 2) Products: 4" through 6":
    - (a) Anvil Fig. 181, 271
    - (b) Cooper/B-Line Fig. 3110, 3117
    - (c) Erico Model 610
    - (d) Nibco/Tolco Fig. 324, 327
  - 3) Products: 8" and Above:
    - (a) Anvil Fig. 171, 271
    - (b) Cooper/B-Line Fig. 3114, 3117
    - (c) Erico Model 605
    - (d) Nibco/Tolco Fig. 322, 327
- c. Continuous Channel with Clevis Type: Service: Plastic Tubing, Flexible Hose, Soft Copper Tubing:
  - 1) Products:
    - (a) Cooper/B-Line Fig. B3106, with Fig. B3106V
    - (b) Erico Model 104, with Model 104V
    - (c) Nibco/Tolco Fig. 1V
- d. Adjustable Swivel Ring Type:
  - 1) Service: Bare Metal Pipe - 4 inches and Smaller
  - 2) Bare Steel Pipe:
    - (a) Anvil Fig. 69
    - (b) Cooper/B-Line Fig. B3170NF
    - (c) Erico Model FCN

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- (d) Nibco/Tolco Fig. 200
- 3) Bare Copper Pipe:
  - (a) Cooper/B-Line Fig. B3170CTC
  - (b) Erico 102A0 Series
  - (c) Nibco/Tolco Fig. 203
- 7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
  - a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
  - b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
- 8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
  - a. Clamp Type:
    - 1) Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller
    - 2) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
    - 3) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
    - 4) Bare Steel, Plastic or Insulated Pipe:
      - (a) Unistrut Fig. P1100 or P2500
      - (b) Cooper/B-Line Fig. B2000 or B2400
      - (c) Nibco/Tolco Fig. A-14 or 2STR
    - 5) Bare Copper Pipe:
      - (a) Cooper/B-Line Fig. BVT
  - b. Roller Type:
    - 1) Service: Insulated Hot Pipe - 4 inches and larger.
    - 2) Products: 4" through 6":

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- (a) Unistrut Fig. P2474
- (b) Cooper/B-Line Fig. B218
- (c) Nibco/Tolco Fig. ROL-12

3) Products: 8" and Above:

- (a) Unistrut Fig. P2474-1
- (b) Cooper/B-Line Fig. B219
- (c) Nibco/Tolco Fig. ROL-13

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

1) Products:

- (a) Anvil Fig. 92
- (b) Cooper/B-Line Fig. B3033/B3034
- (c) Erico Model 300
- (d) Nibco/Tolco 68

b. Steel Structure Clamps: Scissor Type Beam Clamps (for use with bar-joists and wide flange):

1) Products:

- (a) Anvil Fig. 228, 292
- (b) Cooper/B-Line Fig. B3054
- (c) Erico Model 360
- (d) Nibco/Tolco Fig. 329

c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):

1) Products:

- (a) MCL. M1, M2 or M3

d. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

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- e. Steel Structure Welding:
  - 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.
- f. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.
  - 1) Minimum allowable tension loads for Douglass Fir/Southern Pine:
    - (a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
    - (b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".
  - 2) Limitations:
    - (a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer<sup>TMTM</sup>s approval.
    - (b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
    - (c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
    - (d) Spacing: Refer to wood structure spacing of hangers.
  - 3) Products:
    - (a) Simpson RWV
    - (b) DeWALT
    - (c) ITI Sammys GT25

### 2.4 FOUNDATIONS, BASES, AND SUPPORTS

#### A. Basic Requirements:

- 1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
- 2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

#### B. Concrete Bases (Housekeeping Pads):

- 1. Refer to Section 220550 for additional requirements for concrete bases in seismic applications.

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2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).
3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.

### C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

### D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

## 2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.
- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

## 2.6 ROOF PENETRATIONS

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- A. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: [White][Black][Insert] shall match roofing membrane.
- B. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

### 2.7 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas.
- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
  - 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
  - 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.



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3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
5. Sealing element shall be as follows:

		Element	
Model	Service	Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

K. Manufacturers:

1. Thunderline Corporation "Link-Seals"
2. O-Z/Gedney Company
3. Calpico, Inc.
4. Innerlynx
5. Metraflex Company (cold service only)

**2.8 ESCUTCHEON PLATES AND TRIM**

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

**2.9 PIPE PENETRATIONS**

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

**2.10 PIPE ANCHORS**

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

**PART 3 - EXECUTION**

**3.1 PLUMBING SUPPORTS AND ANCHORS**

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.

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6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
  7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
  8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.
- D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
  2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
    - a. The hanger is attached within 6" from a web/chord joint.
    - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
  3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
  4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" & under: 7'-0"
      - 2) 1-1/2": 9'-0"
      - 3) 2": 10'-0"
      - 4) 2-1/2": 11'-0"

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- 5) 3": 12'-0"
- 6) 4" & larger: 12'-0"
- 2. Steel (Std. Weight or Heavier - Vapor Service):
  - a. Maximum Spacing:
    - 1) 1-1/4" and under: 9'-0"
    - 2) 1-1/2": 12'-0"
    - 3) 2" & larger: 12'-0"
- 3. Hard Drawn Copper & Brass (Liquid Service):
  - a. Maximum Spacing:
    - 1) 3/4" and under: 5'-0"
    - 2) 1": 6'-0"
    - 3) 1-1/4": 7'-0"
    - 4) 1-1/2" 8'-0"
    - 5) 2": 8'-0"
    - 6) 2-1/2": 9'-0"
    - 7) 3": 10'-0"
    - 8) 4": 12'-0"
    - 9) 6": 12'-0"
- 4. Hard Drawn Copper & Brass (Vapor Service):
  - a. Maximum Spacing:
    - 1) 3/4" & under: 7'-0"
    - 2) 1": 8'-0"
    - 3) 1-1/4": 9'-0"
    - 4) 1-1/2": 10'-0"
    - 5) 2": 11'-0"
    - 6) 2-1/2" & larger: 12'-0"

- I. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

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1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
  - a. Maximum Spacing:
    - 1) 1-1/4" & under: 7'-0"
    - 2) 1-1/2": 9'-0"
    - 3) 2": 10'-0"
    - 4) 2-1/2": 11'-0"
    - 5) 3": 12'-0"
    - 6) 4" through 6": 12'-0"
    - 7) 8": 9'-0"
    - 8) 10": 6'-0"
    - 9) 12": 4'-0"
2. Steel (Std. Weight or Heavier - Vapor Service):
  - a. Maximum Spacing:
    - 1) 1-1/4" and under: 9'-0"
    - 2) 1-1/2": 12'-0"
    - 3) 2" & larger: 12'-0"
    - 4) 2-1/2": 11'-0"
    - 5) 3": 12'-0"
    - 6) 4" through 8": 12'-0"
    - 7) 10": 9'-0"
    - 8) 12": 6'-0"
3. Hard Drawn Copper & Brass (Liquid Service):
  - a. Maximum Spacing:
    - 1) 3/4" and under: 5'-0"
    - 2) 1": 6'-0"
    - 3) 1-1/4": 7'-0"
    - 4) 1-1/2" 8'-0"

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- 5) 2": 8'-0"
- 6) 2-1/2": 9'-0"
- 7) 3": 10'-0"
- 8) 4": 12'-0"
- 9) 6": 12'-0"

4. Hard Drawn Copper & Brass (Vapor Service):

a. Maximum Spacing:

- 1) 3/4" & under: 7'-0"
- 2) 1": 8'-0"
- 3) 1-1/4": 9'-0"
- 4) 1-1/2": 10'-0"
- 5) 2": 11'-0"
- 6) 2-1/2" & larger: 12'-0"

J. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

**END OF SECTION 22 0529**

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**SECTION 22 0548  
PLUMBING VIBRATION ISOLATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Bases.
- B. Vibration Isolation.
- C. Flexible Connectors.

**1.2 SUBMITTALS**

- A. Vibration isolation submittals may be included with equipment being isolated but must comply with this section.
- B. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- C. Isolator submittals shall include:
  - 1. Equipment served
  - 2. Type of Isolator
  - 3. Load in Pounds per Isolator
  - 4. Recommended Maximum Load for Isolator
  - 5. Spring Constants of Isolators (for Spring Isolators)
  - 6. Load vs. Deflection Curves (for Neoprene Isolators)
  - 7. Specified Deflection
  - 8. Deflection to Solid (at least 150% of calculated deflection)
  - 9. Loaded (Operating) Deflection
  - 10. Free Height
  - 11. Loaded Height
  - 12.  $K_x/K_y$  (horizontal to vertical stiffness ratio - for spring isolators)
  - 13. Materials and Coatings
  - 14. Spring Diameters
- D. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 220550. Include the following:

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1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
  - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

### **PART 2 - PRODUCTS**

#### **2.1 BASIC CONSTRUCTION AND REQUIREMENTS**

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 220550.
- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio ( $K_x/K_y$ ) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. Provide motor slide rails for belt-driven equipment per Section 220513.
- I. All isolators, except M1, shall have provision for leveling.
- J. All components in contact with potable water shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act and NSF/ANSI-61 Low Lead Requirements for Drinking Water.

#### **2.2 BASES**

- A. Type B1:

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1. Rectangular structural steel bases.
2. All perimeter members shall be beams or channels with minimum depth of 10% of the longest base dimension or 14" maximum if rigidity is acceptable to the equipment manufacturer.
3. Use height saving brackets, unless noted otherwise.
  - a. Manufacturers:
    - 1) Mason "WF"
    - 2) Kinetics "SBB"
    - 3) Aeroflex
    - 4) Vibration Eliminator Co. "AF".

### **PART 3 - EXECUTION**

#### **3.1 GENERAL INSTALLATION**

- A. Install all products per manufacturer's recommendations.
- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as pipes supported on a strut rack.

#### **3.2 PIPE ISOLATION**

- A. The first three hangers from vibration-isolated equipment shall be type H1.
- B. Provide sufficient piping flexibility for vibrating equipment or furnish flexible connectors with appropriate temperature and pressure ratings.
- C. Vibration isolators shall not cause any change in position of piping that will result in stresses in connections or misalignment of shafts or bearings. Equipment and piping shall be maintained in a rigid position during installation. Do not transfer load to the isolators until the installation is complete and under full operational load. Hanger H3 and Mounting M4 may be used instead of other products for this purpose.

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D. Support piping to prevent extension of flexible connectors.

**3.3 VIBRATION ISOLATION SCHEDULE**

A. Inline Pumps:

1. Base Type: NA
2. Static Deflection: [0.75" ]
3. Flexible Connections: NA

B. Air Compressor or Vacuum Pump:

1. Base Type: NA
2. Isolator Type: M1
3. Static Deflection: NA
4. Flexible Connections: NA

**END OF SECTION 22 0548**

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**SECTION 22 0550  
SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

A. Seismic Requirements.

**1.2 QUALITY ASSURANCE**

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 22 0529 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

D. Installer: Company specializing in performing the work of this Section.

**1.3 REFERENCES**

A. International Building Code, 2018 w/ Northern Nevada Amendments.

B. ASHRAE - A Practical Guide to Seismic Restraint.

C. ASCE 7-16, Chapter 13.

D. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.

**1.4 SUBMITTALS**

A. Submit under provisions of Section 22 0500.

**Seismic Requirements for Equipment and Supports -  
22 0550**

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- B. Submittal to Code Official:
1. Contractor shall submit copies of the seismic shop drawings to the governing code authority for approval.
- C. Shop Drawings:
1. Calculations, restraint selections, and installation details shall be designed and sealed by a [Professional][Structural] Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
  2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of mechanical components with other systems and equipment in the vicinity, including other seismic restraints.
  3. Manufacturer's Certifications: Professional [Structural] Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
  4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
    - a. Calculations for each seismic brace and detail utilized on the project.
    - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
    - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
    - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
  5. Equipment - Submit for each piece of equipment supplied:
    - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified.
    - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
    - c. Engineering calculations and details for equipment anchorage and support structure.
- D. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

### 1.5 TESTING AND INSPECTION

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- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the International Building Code.
- B. The[[Contractor] shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

### 1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, [2018] edition.
- B. The following criteria are applicable to this project:
  - 1. Risk Category: [IV]
  - 2. Seismic Importance Factor:  $IE = [1.0]$
  - 3. Seismic Design Category: [D]
  - 4. Component Amplification Factors ( $a_p$ ) and Component Response Modification Factors ( $R_p$ ) shall be taken from Table [13.5-1 in ASCE 7-16] for the individual equipment or system being restrained.
  - 5. Component Importance Factors ( $I_p$ ) shall be taken from Section [13.1.3 in ASCE 7-16] for the individual equipment or system being restrained.
  - 6. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements and Equations [13.3-1, -2, and -3 of ASCE 7-10, unless exempted by 13.1.4][ 13.3-1, -2, and -3 of ASCE 7-16, unless exempted by 13.1.4].
- D. Equipment shall meet [International] Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table

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Testing of Nonstructural Components and Systems.

### 1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

### 1.9 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

## PART 2 - PRODUCTS

### 2.1 SUPPLIERS

- A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:
  - 1. B-Line Systems, Inc. (800) 851-7415, [www.b-line.com](http://www.b-line.com).
  - 2. Unistrut Corporation <http://www.unistrut.us/>
  - 3. Kinetics Noise Control (877) 457-2695, [www.kineticsnoise.com](http://www.kineticsnoise.com).
  - 4. Mason Industries, Inc. [www.mason-ind.com](http://www.mason-ind.com).
  - 5. Loos & Co., Inc. (800) 321-5667, [www.loosnaples.com](http://www.loosnaples.com).
  - 6. Tolco (909) 737-5599, [www.tolco.com](http://www.tolco.com)
  - 7. ISAT 877.523.6060, [www.isatsb.com](http://www.isatsb.com)
  - 8. Vibro-Acoustics (416) 291-7371, <https://virs.vibro-acoustics.com/>

### 2.2 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
- B. Definitions:
  - 1. Stay in Place:
    - a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.
- C. Remain Operational:
  - 1. Requirements for "Stay in Place" listed above shall be met.

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2. The following systems and associated equipment are intended not to fail externally or internally and are intended to continue operation following a seismic event:
  - a. Plumbing
  - b. Medical Gas

### 2.3 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

#### A. General:

1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.

#### B. Friction from gravity loads shall not be considered resistance to seismic forces.

#### C. Fire protection systems shall meet the requirements of NFPA-13 and NFPA-14 for the building seismic requirements.

#### D. Housekeeping Pads:

1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

### 2.4 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

#### A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

#### B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:

1. Air Compressors
2. Tanks

### 2.5 MATERIALS

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- A. Use the following materials for restraints:
  - 1. Indoor Dry Locations: Steel, zinc plated.
  - 2. Outdoors and Damp Locations: Galvanized steel.
  - 3. Corrosive Locations: Stainless steel.

### 2.6 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

### 2.7 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
  - 1. Materials for Channel: ASTM A1011, GR 33.
  - 2. Materials for Fittings and Accessories: ASTM A635, ASTM A576, or ASTM A36.
  - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
  - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

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- C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.

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- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Water tanks shall be secured to their saddles by welding or proper concrete attachment, and those saddles shall be properly attached to the structure.
- V. Brace all terminal units with water coils as required by the building code and provide flexible connection to the coil if bracing is required.
- W. Independently brace duct mounted equipment (terminal units, in-line fans, etc.) and the associated suspended ductwork.
- X. Do not brace a system to two different structures such as a wall and a ceiling.
- Y. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- Z. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- AA. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
- BB. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

### 3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

**END OF SECTION 22 0550**

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**SECTION 22 0553  
PLUMBING IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Identification of products installed under Division 22.

**1.2 REFERENCES**

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B-1, B-3, and B-8 for copper conductors.
- C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 “ 2kV Cables.
- D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
- E. NFPA-99 “ Health Care Facilities.
- F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 220500. Include list of items identified, wording, letter sizes, and color coding.
- B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. 3M
- B. Bunting
- C. Calpico
- D. Craftmark
- E. Emedco
- F. Kolbi Industries
- G. Seton
- H. W.H. Brady

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### I. Marking Services

#### 2.2 MATERIALS

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

Plastic tags may be used for outside diameters under 3/4"

- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- H. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.
- I. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.
- J. Tracer Wire:
1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
  2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
  3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.

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### C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
6. Number all tags and show the service of the pipe.
7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

### D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Stencil Painted Pipe Markers:
  - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
  - b. Apply primer on non-insulated pipes before painting.
  - c. Use background and letter colors as scheduled later in this section.
4. Apply markers and arrows in the following locations where clearly visible:
  - a. At each valve.
  - b. On both sides of walls that pipes penetrate.
  - c. At least every 20 feet along all pipes.
  - d. On each riser and each leg of each "T" joint.
  - e. At least once in every room and each story traversed.
5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

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### E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

### 3.2 SCHEDULE

#### A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. HIGH TEMP HOT WATER OVER 240°F: Black lettering; yellow background
2. CONDENSATE DRAIN: White lettering; green background
3. COMPRESSED AIR: White lettering; green background
4. CONTROL COMPRESSED AIR: White lettering; green background
5. DOMESTIC COLD WATER: White lettering; green background
6. DOMESTIC HOT WATER - 115°F: White lettering; green background
7. DOMESTIC HOT WATER - 140°F: White lettering; green background
8. DOMESTIC HOT WATER CIRCULATING - 115°F: White lettering; green background
9. DOMESTIC HOT WATER CIRCULATING - 140°F: White lettering; green background
10. SANITARY SEWER: Black lettering; yellow background
11. VENT: Black lettering; yellow background
12. STORM SEWER (PRIMARY AND SECONDARY): White lettering; green background
13. NATURAL GAS: Black lettering; yellow background
14. TEMPERED WATER: White lettering; green background
15. TEMPERED WATER RETURN: White lettering; green background
16. MEDICAL VACUUM - 15-30 IN. HG: Black lettering; white background
17. WASTE ANESTHETIC GAS DISPOSAL - 15-30 IN. HG: White lettering; violet background
18. CARBON DIOXIDE - 50-55 PSI: White lettering; gray background
19. INSTRUMENT AIR - 160-185 PSI: White lettering; black background

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20. MEDICAL AIR - 50-55 PSI: Black lettering; yellow background
  21. NITROGEN - 160-185 PSI: White lettering; black background
  22. NITROUS OXIDE - 50-55 PSI: White lettering; blue background
  23. OXYGEN - 50-55 PSI: White lettering; green background
  24. HYPERBARIC OXYGEN - 70-75 PSI: White lettering; green background
  25. FUEL OIL SUPPLY: Black lettering; yellow background
  26. FUEL OIL RETURN: Black lettering; yellow background
- B. Non-Potable Piping: All piping conveying non-potable water shall be permanently identified by[ continuously painted][ or][ continuous adhesive backed marker] along entire length of pipe and branches so the piping is readily distinguishable from piping carrying potable water. Pipe markers shall be located as described above.
1. NON-POTABLE WATER: White lettering; purple background
  2. IRRIGATION WATER: White lettering; purple background
  3. DEIONIZED WATER: White lettering; purple background
  4. DISTILLED WATER: White lettering; purple background
  5. RO WATER: White lettering; purple background
- C. Medical gas pipe markers shall include the system operating pressure shown above.
- D. Medical gas pipe markers for systems not listed shall meet the pipe labeling requirements of NFPA-99.

**END OF SECTION 22 0553**

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**SECTION 22 0716  
PLUMBING EQUIPMENT INSULATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Equipment Insulation.
- B. Equipment Insulation Finishes.

**1.2 QUALITY ASSURANCE**

- A. Applicator: Company specializing in insulation application with five years minimum experience.
- B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

**1.3 REFERENCES**

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate
- C. ANSI/ASTM C534 - Elastomeric Foam Insulation
- D. ANSI/ASTM C921 - Properties of Jacketing Materials for Thermal Insulation
- E. ANSI/ASTM D1668 - Glass Fabric for Waterproofing
- F. ASTM E84 - Surface Burning Characteristics of Building Materials.
- G. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.
- H. NFPA 255 - Surface Burning Characteristics of Building Materials.
- I. UL 723 - Surface Burning Characteristics of Building Materials.

**PART 2 - PRODUCTS**

**2.1 INSULATION**

- A. Type A: Glass Fiber Blanket; ANSI/ASTM C612; 0.40 maximum 'K' value at 300°F ; 3.0 lb./cu ft. ; suitable to 850°F , 25/50 flame spread/smoke developed.
- B. Type B: Glass Fiber Board; ANSI/ASTM C612; 0.28 maximum 'K' value at 200°F ; 6.0 lb./cu ft ; suitable to 850°F , 25/50 flame spread/smoke developed.
- C. Type C: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F , 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers

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are specified.

### 2.2 INSULATION FINISHES

- A. Type 1: Glass Fabric; ASTM D1668, woven glass fabric with two coats of mastic approved for insulation type. Use vapor barrier mastic on system requiring a vapor barrier.
- B. Type 2: All Service Jacket; ASTM C921; Factory or Field Applied; all-purpose polymer or polypropylene service jacket; Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Seal all joints with manufacturer approved tape and adhesive to maintain vapor barrier. Indoor use only, if used outdoors add type 4 finish.
- C. Type 3: Flexible Elastomeric Thermal Insulation; After adhesive has fully cured, apply two coats of latex enamel paint approved by insulation manufacturer for outdoor use.
- D. Type 4: Aluminum Jacket; ASTM B209; 0.016" thick stucco embossed finish; install with 3/4" aluminum bands 12" on center.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all materials per manufacturer's instructions, codes and industry standards.
- B. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.
- C. Do not insulate factory insulated equipment.
- D. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation. Secure to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier mastic.
- F. Do not insulate over nameplates or ASME stamps. Bevel and seal insulation around such, unless omitting insulation would cause condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items.
- G. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning; install specially fabricated removable insulation sections. Covers shall have mechanical fasteners and be reusable.
- H. Install 26 gauge galvanized sheet metal corner protection angles where insulation extends to the floor. Minimum 2" coverage of insulation.
- I. Insulate all equipment surfaces that are not factory insulated and are intended to operate below 60°F and/or above 100°F. Verify insulation type and thickness with equipment manufacturer and Architect/Engineer.
- J. Insulate all supports on equipment operating below ambient temperature.

### 3.2 INSULATION

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### A. Type A and B:

1. Apply with edges tightly butted and joints staggered.
2. Secure with welded pins and washers, 4" from each edge and 16" on center, or 1/2" x 0.015" galvanized steel bands, 12" on center.

### B. Type C:

1. Apply with edges tightly butted and joints staggered. Install multiple layers if required thickness is greater than 1" thick.
2. Secure with manufacturer approved adhesive. Seal all joints with manufacturer approved adhesive.

## 3.3 SCHEDULE

- A. Domestic Hot Water Storage Tank (up to 250°F ): 2" thick Type B; Finish 1 or 2.

**END OF SECTION 22 0716**

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**SECTION 22 0800  
COMMISSIONING OF PLUMBING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Description
- B. Responsibilities
- C. Related Work

**1.2 DESCRIPTION**

- A. The purpose of this section is to specify Division 22 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in the Commissioning Plan (Cx Plan). Refer to Section 019100.
- C. Commissioning requires the participation of the Division 22 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019113. Division 22 Contractor shall be familiar with all parts of Section 019100 and the commissioning plan issued by the CxA, and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

**1.3 RESPONSIBILITIES**

- A. Refer to the Cx Plan in the appendix of Section 019100.

**1.4 RELATED WORK**

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
  - 1. Section 01 7800 - Closeout Procedures and Submittals
  - 2. Section 01 9113 - Commissioning
  - 3. Section 23 0800 - Commissioning of HVAC
  - 4. Section 26 0800 - Commissioning of Electrical
  - 5. Section 270800 - Commissioning of Communications
  - 6. Section 280800 - Commissioning of Electronic Safety and Security

**PART 2 - PRODUCTS**

**PART 3 - EXECUTION**

**END OF SECTION 22 0800**

**Commissioning of Plumbing - 22 0800**

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**SECTION 22 1000  
PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Check Valves.

**1.2 QUALITY ASSURANCE**

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- C. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

**1.3 REFERENCES**

- A. ANSI/ASME A112.3.1 - Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below Ground.
- B. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- C. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- D. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- E. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- F. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- G. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- H. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- I. ANSI/ASTM B32 - Solder Metal.
- J. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.
- K. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.
- L. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- M. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.

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- N. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- O. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.
- P. ASTM B88 - Seamless Copper Water Tube.
- Q. ASTM B306 - Copper Drainage Tube (DWV).
- R. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- S. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- T. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- U. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- V. ASTM D2661 - ABS DWV Pipe & Fittings.
- W. ASTM D2665 - PVC DWV Pipe & Fittings.
- X. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
- Y. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- Z. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.
- AA. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
- BB. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- CC. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
- DD. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
- EE. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- FF. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- GG. AWS A5.8 - Brazed Filler Metal.
- HH. AWWA C651 - Disinfecting Water Mains.
- II. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

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JJ. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

KK.FM 1680 - Couplings Used in Hubless Cast Iron Systems.

LL. NFPA 54 - National Fuel Gas Code.

MM. NSF - National Sanitation Foundation

### 1.4 SUBMITTALS

A. Submit shop drawings per Section 22 0500.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

### 1.6 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 220500 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

## PART 2 - PRODUCTS

### 2.1 CAST IRON PIPE

A. Cast Iron; Standard Weight; Hub and Spigot Joints:

1. Pipe: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, [CISPI 301 or ASTM A888][CISPI 301 and CISPI Trademark].
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
4. Adapters: Heavy duty no-hub transition for joining cast iron and PVC pipe. Adapters shall be tested and certified to ASTM C 1460 and be constructed with Type 304 stainless steel shield, thickness 0.015" shield, gasket material to meet ASTM C564, 1-1/2" to 4" will be 3" wide with four 304 stainless steel bands, and 6" to 10" will be 4" wide with six 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds.

B. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:

1. Pipe: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, [CISPI 301 or ASTM A888][CISPI 301 and CISPI Trademark].
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.

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4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 310. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
  5. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
- C. Cast Iron; Standard Weight Epoxy Coated; No-Hub Sleeve Gaskets:
1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, epoxy paint corrosion protective coating inside and outside, [CISPI 301 or ASTM A888][CISPI 301 and CISPI Trademark].
  2. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
  3. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
  4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

## 2.2 COPPER PIPE

- A. Copper Pipe; Type L; Solder Joints:
1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
  2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
  3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
  4. Fittings: Wrought copper solder joint, ANSI B16.22.
- B. Copper Pipe; Type L; Mechanical Press Connection:
1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
  2. Design Pressure: 175 psi; Maximum Design Temperature: 200°F.
  3. Joints: Mechanical press connection.
  4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
  5. Manufacturers:
    - a. Viega ProPress
    - b. Elkhart Xpress
    - c. Nibco Press System Fittings and Valves

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- d. Mueller Streamline PRS
- C. Copper Pipe; Type K; Solder Joints:
  - 1. Pipe: Type K annealed copper tube, ASTM B88.
  - 2. Design Pressure: 150 psi. Maximum Design Temperature: 200°F.
  - 3. Joints: [Solder with 100% lead-free solder and flux ASTM B32][BCuP silver braze, AWS A5.8].
  - 4. Fittings: Wrought copper solder joint, ANSI B16.22.
- D. Copper Pipe; Type K; Mechanical Press Connection:
  - 1. Pipe: Type K annealed copper tube, ASTM B88.
  - 2. Design Pressure: 150 psi. Maximum Design Temperature: 200°F.
  - 3. Joints: Mechanical press connection.
  - 4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
  - 5. Manufacturers:
    - a. Viega ProPress
    - b. Elkhart Xpress
    - c. Nibco Press System Fittings and Valves
    - d. Mueller Streamline PRS.
- E. Copper Pipe: Type DWV; Solder Joints:
  - 1. Pipe: Type DWV hard temper seamless copper drainage tube, ASTM B306.
  - 2. Design Pressure: Gravity Maximum Design Temperature: 180°F
  - 3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
  - 4. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

### 2.3 PLASTIC PIPE

- A. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:
  - 1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
  - 2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
  - 3. Fittings: PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.

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4. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
  5. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.
  6. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 220516 for expansion joint requirements.
- B. PVC Pressure Pipe; Class [165][235], C900; Push-On Joints - Pressure Pipe:
1. Pipe: PVC pressure pipe, Class [165 psi][235 psi] ANSI/AWWA C900 approved, bell and spigot ends.
  2. Joints: Push-On Type ASTM D3139, elastomeric ring seal per ASTM F477, bevel spigot ends.
  3. Fittings: PVC bell and spigot type, Class 150; 235 psig rating, ASTM D1784.
- C. PVC Pressure Pipe; Schedule 40/SDR26; Push-On Joints - Pressure Pipe:
1. Pipe: PVC pipe, Schedule 40 and SDR 26 or less with bell and spigot ends, ASTM D1785 or ASTM D3034. Cellular core piping is not acceptable.
  2. Joints: Elastomeric gaskets, ASTM F477.
  3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.
  4. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.
- D. Polypropylene (fire retardant); Schedule 40 Drainage; Electrically Fused Joints:
1. Pipe: Fire retardant polypropylene Schedule 40 drainage pipe.
  2. Joints:
    - a. Join pipe and fittings with electrically fused joints. Make fittings between dissimilar materials with adapters furnished by the polypropylene pipe manufacturer.
    - b. Above Floor Only: Mechanical joint with gasket, stainless steel outer sleeve and corrosion resistant nuts and bolts or threaded fittings with gasket and compression nuts.
  3. Fittings: Fire retardant polypropylene DWV pattern with socket ends for electrically fused joints. Pipe and fittings shall be a system provided by the same manufacturer.
  4. Limitations: For use in non-return air plenums.
  5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 220516 for

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expansion joint requirements.

### E. Chlorinated Polyvinyl Chloride (CPVC); Schedule 40 Drainage; Solvent Weld Joints:

1. Pipe: Chlorinated polyvinyl chloride (CPVC) Schedule 40 drainage pipe, ASTM F1412, NSF Listed.
2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer, ASTM F493.
3. Fittings: Chlorinated polyvinyl chloride (CPVC) DWV pattern with socket ends for Schedule 40 pipe.
4. Limitations: CPVC shall not be used in a return air plenum unless it is specifically listed to ASTM E84 and/or UL723. CAN ULC S102.2 listing is not acceptable.
5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 220516 for expansion joint requirements.

## 2.4 VALVES

### A. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. Gate Valves:
  - a. GA-1: 2" and under, 150# steam @ 406°F, 300# CWP @ 150°F, screwed, bronze, rising stem, screwed bonnet. Crane #431, Hammond #IB641, Stockham #B122, Walworth #56, Milwaukee #1150, Watts #B-3210, Nibco T-131.
  - b. GA-2: 2-1/2" thru 12", 125 psi S @ 353°F, 200 psi CWP @ 150°F, flanged, iron body, bronze mounted, OS&Y. Crane #465-1/2, Hammond, Stockham #G623, Walworth, Milwaukee #F2885, Watts #F-503, Nibco F-617-0.
  - c. GA-7: 2-1/2" thru 12", 200# CWP @ 150°F, flanged, iron body, bronze trim, OS&Y. Crane #475-1/2, Hammond #IR1146, Stockham #G624, Walworth #8727F, Milwaukee #F2891, Nibco F-617-0.
  - d. GA-12: 2-1/2" thru 12", 200# CWP, hub ends, iron body, bronze mounted, double disc, parallel seat, "O" ring stem seals, non-rising stem with mounting flange for indicator post or valve box and 2" square nut, counter-clockwise to open, AWWA. Mueller #A-2380-5, Kennedy #56.
  - e. GA-13: 2" thru 12", 200# CWP, mechanical joint ends, iron body, bronze mounted, double disc, parallel seat, "O" ring stem seals, non-rising stem with mounting flange for indicator post or valve box and 2" square nut, counter-clockwise to open, AWWA. Mueller #A-2380-20, Kennedy #571X.
3. Butterfly Valves:

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- a. BF-1:
  - 1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°F to 250°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or EPDM coated ductile iron disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.
  - 2) 8" thru 12", 175# CWP, elastomers for 20°F to 225°F at 130 psi, fully lugged end, ductile or cast iron body (not in contact with fluid), bronze, EPDM coated ductile iron or aluminum-bronze disc, EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to the centerline of the valve body (to permit pipe extension without draining system), weatherproof gear operator. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1G, Stockham LD722-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.

#### 4. Ball Valves:

- a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.
  - 1) Provide solid extended shaft for all insulated piping.
  - 2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.
- b. BA-1A: 2-1/2" and 3", 150 psi saturated steam, 275 psi CWP ANSI Class, 150 psi standard port, carbon steel body stainless steel ball and trim, Teflon seats and seals. Apollo #88A-100, Stockham #3951-CS-R-66-LL, Nibco #F510-CS/66, Milwaukee #F90.
  - 1) Provide extended shaft for all valves in insulated piping.
  - 2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.
- c. BA-9: 2" and under, 150 psi saturated steam, 600 psi CWP, standard port, screwed (solder ends are acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body and ball of copper alloy containing less than 15% zinc, chrome plated or stainless steel ball, Teflon seats and seals with memory stop. Apollo #70-120, Stockham

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#S-255-FB-P-UL, Milwaukee #BA-100, Watts #B-6000, Hammond #8501, Nibco #580-70.

1) Provide solid extended shaft for all valves in insulated piping.

- d. BA-11: 2" and under, 300 psig water, standard port, screwed or compression. Bronze body and ball of a copper alloy containing less than 15% zinc, chrome plated, Teflon coated, or stainless steel ball. Teflon or Buna-N seats. One piece "T" style cap and stem. A.Y. McDonald 6100 Series, Mueller 300 Series.
- e. BA-12: 2" and under, 300 psig water, standard port, screwed or compression. Bronze body and ball of a copper alloy containing less than 15% zinc, chrome plated, Teflon coated, or stainless steel ball. Teflon or Buna-N seats. One piece "T" style cap and stem. Minneapolis Pattern threaded top. A.Y. McDonald 6100 Series, Mueller 300 Series.

### B. Throttling Valves

#### 1. Globe Valves:

- a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.
- b. GL-2: 2-1/2" thru 10", 125# steam @ 353°F, 200# CWP @ 150°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

#### 2. Plug Valves:

- a. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.
- b. PL-2: 2-1/2" thru 4", 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port. Walworth #1700F, DeZurik #425, F-RS49.
- c. PL-3: 6" and larger, 125# steam @ 450°F, 175# CWP, cast iron body, flanged, resilient faced plug, gear and handwheel operator, full port. Walworth #1700F, DeZurik #118, F-RS24.
- d. PL-13: 2" and under, 175# CWP, 250°F elastomer, screwed, bronze body, resilient plug facing (RS-55), adjustable memory stop, non-removable lever handle. DeZurik #120-S.
- e. PL-15: 2-1/2" thru 8", 150# CWP, 250°F elastomer, flanged, bronze body, resilient plug facing (RS-55 or RS-56), adjustable memory stop. DeZurik #120-F.

## 2.5 STRAINERS

- A. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
- B. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.

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- C. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 350°F, 175 psi CWP @ 150°F. Armstrong #A1FL, Metraflex #TF, Mueller Steam Specialty Co.#751, Sarco #CI-125, Watts #77F-D.
- D. ST-4: Cast iron body, screwed ends, screwed cover, 250# steam @ 406°F, 300# CWP @ 150°F. Armstrong #A1SC, Metraflex #SM, Mueller Steam Specialty Co. #11, Sarco #IT.
- E. ST-7: 2-1/2" thru 8", bronze body, flanged ends, flanged cover, 150# steam, 225# CWP. Mueller Steam Specialty Co. #851.

### 2.6 CHECK VALVES

- A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
- B. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.
- C. CK-5: 2" and under, 250# CWP, screwed, all iron, horizontal swing. Crane #346-1/2.
- D. CK-6: 2-1/2" thru 12", 125# steam @ 450°F, 200# CWP @ 150°F, flanged, all iron, horizontal swing. Crane #373-1/2, Hammond #IR1126, Stockham #G933, Walworth #8928-1/2F, Milwaukee #F-2971, Watts #F-511-R, Nibco F-918N.
- E. CK-13: 2-1/2" thru 12", 200# CWP, double disc wafer type, iron body, bronze or aluminum-bronze discs, 316SS shaft and spring, Viton, EPDM or BUNA-N, Cv of at least 700 in 6" size. Mueller Steam Specialty Co. #71-AHB-6-H, Stockham #WG-961 EPDM or #WG-970 BUNA, NIBCO W-920-W, Crane.
- F. CK-14: 2-1/2" thru 12", 200# CWP, double disc wafer type, bronze or iron body, bronze trim, metal-to-metal or Viton seat, 316 SS shaft, Inconel 600 spring. Mission Duo Chek #12HPP (with Inconel springs), Mueller Steam Specialty Co. #71-AHB-K-W, Stockham #WG-961-EPDM or #WG-970-BUNA, Nibco w-920-W.
- G. CK-20: 2" and larger, 125# CWP, flanged, iron body, cast iron or carbon steel body with stainless steel internals. Hoerbiger Design "CT". Note: Use only for compressor discharge.

### 2.7 VALVE CONNECTIONS

- A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

### 2.8 CONNECTIONS BETWEEN DISSIMILAR METALS

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

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- C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:
  - 1. Iron and steel connected to each other.
  - 2. Brass, copper, and bronze connected to each other.
  - 3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
  - 1. Dielectric waterway rated for 300 psi CWP and 225°F.
  - 2. Manufacturers:
    - a. Elster Group ClearFlow fittings
    - b. Victaulic Series 647
    - c. Grinnell Series 407
    - d. Matco-Norca
- F. Flanged Joints (any size):
  - 1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
  - 2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
  - 3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
  - 4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
  - 5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
  - 6. Manufacturers:
    - a. EPCO
    - b. Central Plastics
    - c. Pipeline Seal and Insulator
    - d. F. H. Maloney

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- e. Calpico

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt, on inside and outside, before assembly.
- D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.
- E. Connect to equipment with flanges or unions.
- F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.
- G. Roof Penetration (Vent) Flashing:
  - 1. Built-up Roofing: Flash vents with 3# seamless sheet lead of sufficient size to extend 15" into roofing felts for built-up roofs.

#### **3.2 SYSTEM, PIPING AND VALVE SCHEDULE**

- A. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Above Ground):
  - 1. Copper Pipe; Type L; Solder Joints: All Sizes
  - 2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
  - 3. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC); SDR-11; Solvent Weld Joints: 2" and Under
  - 4. Shutoff Valves:[ BF-1][, BA-1]
  - 5. Throttling Valves:[ GL-1][, GL-2]
  - 6. Check Valves:[ CK-1][, CK-14]
  - 7. Strainers:[ ST-1][, ST-7]
- B. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Underground):
  - 1. Copper Pipe; Type K; Solder Joints: All Sizes
  - 2. Copper Pipe; Type K; Mechanical Press Connection: 4" and Under
- C. Sanitary Waste and Vent, Gravity (Above Ground):
  - 1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes

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2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"
  4. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- D. Sanitary Indirect Drainage (Above Ground):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"
- E. Storm Drainage, Gravity (Above Ground):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
  4. Stainless Steel; Type 304; Hub and Spigot Joint: All Sizes
- F. Sanitary Waste and Vent, Gravity (Underground - Inside Building):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- G. Storm Drainage, Gravity (Underground - Inside Building):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes
- H. Sanitary Waste and Vent, Gravity (Underground - Outside Building):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
- I. Storm Drainage, Gravity (Underground - Outside Building):
1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
  2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
  3. Concrete; Reinforced Class III; Tongue and Groove Pipe: 12" and over
  4. Concrete; Reinforced Class III; Modified Bell and Spigot or Tongue and Groove Pipe - Flat Gasket: 12" to 18"



**3.3 TESTING PIPING**

- A. [Sanitary Drainage][, Sanitary Vent][, Storm Drainage]:
  - 1. Test all piping with water to prove tight.
  - 2. Test piping before insulation is applied.
  - 3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
  - 4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
  - 5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
  - 6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
  - 7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.
- B. [Hot Water - Potable and Non-Potable][, Cold Water - Potable and Non-Potable][, Tempered Water - Potable and Non-Potable]:
  - 1. Test pipes underground or in chases and walls before piping is concealed.
  - 2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
  - 3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
  - 4. Hold test pressure for at least 2 hours.
  - 5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
- C. Fire Service:
  - 1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:
    - a. Interior Piping: 0 quarts per hour.
    - b. Underground Piping: 2 quarts per 100 joints per hour.
- D. Vacuum Piping:
  - 1. Testing pipes in chases, walls, or above non-accessible ceilings before piping is concealed.
  - 2. Test with 100 psig compressed air or nitrogen.

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3. During the test, strike all soldered joints sharply with a rubber or rawhide mallet to cause failure of any weak joints. After striking, soap test each joint.
  4. Repair and retest all leaking joints.
  5. After all joints pass the soap test, the system must maintain test pressure for 24 hours. If system fails the 24-hour, retest ALL joints by resoaping and repair all faulty joints. Repeat this procedure until the test pressure can be maintained for 24 hours.
  6. After passing the above test, operate the vacuum pump. With all vacuum valves closed, the pump and piping system shall be able to maintain a vacuum of 25" Hg for at least one hour.
  7. All materials, labor and equipment for testing shall be provided by the installing Contractor.
  8. Tests to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.
  9. After testing, seal the complete system against entry of foreign material until it is turned over to the Owner.
- E. All Other Piping:
1. Test piping at 150% of normal operating pressure.
  2. Piping shall hold this pressure for one hour with no drop in pressure.
  3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
  4. Drain and clean all piping after testing is complete.

### 3.4 CLEANING PIPING

#### A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

#### B. Air Blow:

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1. Blow out pipe and components with clean compressed air. Instrument air, argon, nitrogen and sulfuric acid lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blow out points is clean. Use 80-90 psig pressure unless otherwise indicated.
  2. Air blow applies to the following systems:
    - a. Acetylene
    - b. Carbon Dioxide
    - c. Nitrogen (use oil free air or nitrogen gas)
    - d. Argon (use oil free air or nitrogen gas)
    - e. Instrument Air (use oil free air or nitrogen gas)
    - f. Distilled Water (use maximum of 50 psig pressure)
    - g. Chemical Feed
    - h. Air Compressor Intakes
    - i. Sulfuric Acid (use oil free air or nitrogen gas)
- C. All Water Piping:
1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
  2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
  3. If necessary, remove valves to clean out all foreign material.
- D. Fire Service:
1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
    - a. 390 gpm for 4" pipes.
    - b. 880 gpm for 6" pipes.
    - c. 1560 gpm for 8" pipes.
    - d. 2440 gpm for 10" pipes.
    - e. 3500 gpm for 12" pipes.

### 3.5 INSTALLATION

- A. General Installation Requirements:

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1. Provide dielectric connections between dissimilar metals.
  2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
  3. Group piping whenever practical at common elevations.
  4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
  5. Slope water piping and arrange to drain at low points.
  6. Install bell and spigot piping with bells upstream.
  7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
  8. Seal pipes passing through exterior walls with a wall seal per Section 220529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
  9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
  10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.
- B. Installation Requirements in Electrical Rooms:
1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- C. Installation Requirements in MRI (Magnetic Resonance Imaging - Healthcare):
1. All piping in MRI rooms shall be non-ferrous regardless of materials described on Part 2.
- D. Valves/Fittings and Accessories:
1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
  2. Provide clearance for installation of insulation and access to valves and fittings.
  3. Provide access doors for concealed valves and fittings.
  4. Install valve stems upright or horizontal, not inverted.
  5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.

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6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

### E. Underground Piping:

1. Install buried water piping outside the building with at least [5 feet] of cover. Refer to Section 220500 for Excavation, Fill, Backfill and Compaction requirements
2. Install buried borosilicate glass pipe with the protective polystyrene covering intact. Lay the pipe on bedding and backfill per manufacturer instructions.
3. Install thrust blocking and restraints on all underground fire protection service piping per NFPA 24 and as shown on drawings.
4. Install underground, sleeved, corrugated, stainless steel tubing system according to manufacturer's written instructions. Extend vent from sleeve to exterior of building and terminate with screened elbow.
5. Direct buried, uninsulated steel pipe shall have a factory applied external protective coating consisting of two coats with an intermediate layer of 18 mil fibrous glass mat. Coating thickness shall total not less than 3/32". The outer coating shall be further protected by a wrapping of heavy Kraft paper. This external protection shall extend and be exposed for a minimum of 1 foot beyond the buried or concealed portion of the pipe.
  - a. Manufacturers:
    - 1) Pipe Line Service Co., Franklin Park, Illinois
    - 2) Lithcote Corp., Melrose Park, Illinois
6. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.
  - a. Manufacturers:
    - 1) Republic Steel Corp. "X-Tru-Coat"
7. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
8. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
9. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
10. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

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- F. Sanitary and Storm Piping:
1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
  2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
  3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
  4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.
  5. All sanitary and storm piping shall have at least [42"] of cover when leaving the building.
  6. Starter fittings with internal baffles are not permitted.

### 3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.
- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.

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- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 220500 for Excavation, Fill, Backfill and Compaction requirements.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

### 3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.
- F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.
- G. All vent and drain piping shall be of same materials and construction for the service involved.

### 3.8 PLUMBING VENTS

- A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.
- B. Extend the high side of the soil and waste stacks at least 12" above roof.
- C. Flash pipes at the roof with 3# lead sheet. Extend flashing under roofing 15" in all directions from pipe to be flashed. Extend a lead collar up on the outside of pipe to be flashed and extend 1" beyond the top of the pipe. The 1" excess length of collar shall be turned down into the top of the pipe where it shall fit tight to the inside of the pipe.
- D. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.
- E. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.
- F. In no case shall the vent through the roof be less than 4" in diameter.

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G. Vent pipes through the roof shall be located a minimum of from any air intake opening on the roof.

### 3.9 BRANCH CONNECTIONS

- A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.
- D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
  - 1. Domestic water piping above ground.
- E. Further limit use of mechanically formed fittings as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Main must be Type K or L copper tubing.
  - 3. Permanent marking shall indicate insertion depth and orientation.
  - 4. Branch pipe shall conform to the inner curve of the piping main.
  - 5. Main must be 1" or larger.
  - 6. Branch must be 3/4" or larger.
- F. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- G. Forged weld-on fittings are limited as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Main must be 2-1/2" or larger.
  - 3. Branch line is at least two pipe sizes under main size.

### 3.10 JOINING OF PIPE

- A. Threaded Joints (Galvanized Steel Pipe):
  - 1. Threads shall conform to ANSI B2.1 "Pipe Threads".
  - 2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
  - 3. Protect plated pipe and valve bodies from wrench marks when making up joints.
  - 4. Apply thread lubricant to male threads as follows:



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- a. Vents and Roof Conductors: Red graphite
  - b. All Other Services: Teflon tape
- B. Solder Joints (Copper Pipe):
1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
  2. Flux shall be non-acid type.
  3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.
- C. Brazed Joints (Copper Pipe):
1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BAg-1 or BAg-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing. Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.
  2. Remove discs from solder end valves during brazing.
- D. Mechanically Coupled Grooved Joints (Copper and Galvanized Steel Pipe):
1. Product Warranty:
    - a. Standard: One-year product warranty. A factory-trained manufacturer's representative shall visit the site for contractor training and installation observation.
      - 1) On-site Training: Manufacturer's factory trained representative shall provide training of contractor<sup>TMTM</sup>s field personnel in use of grooving tools and installation of product. Documentation of installing contractor training with manufacturer<sup>TMTM</sup>s representative shall be submitted to the Architect/Engineer.
      - 2) Job Site Visitation: Manufacturer's representative shall periodically visit job site to ensure manufacturer<sup>TMTM</sup>s installation practices are being followed.
    - b. Extended [5]-Year Product Warranty: Manufacturer shall provide extended [5]-year warranty to replace product. Warranty shall include onsite training and inspection of all fittings by manufacturer. Manufacturer inspection report shall be provided to the Owner upon completion.

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- c. Extended [5][15][20][Insert]-Year Product and Installation Warranty: Manufacturer shall provide extended [5][15][20][Insert]-year warranty to replace product and any part of the system damaged as a direct result of a failure of the product. Warranty shall include onsite training and inspection of all fittings by manufacturer. Manufacturer inspection report shall be provided to the Owner upon completion.
- E. Mechanical Press Connection (Copper and Stainless Steel Pipe):
1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
  2. Fully insert tubing into the fitting and mark tubing.
  3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
  4. Joint shall be pressed with a tool approved by the manufacturer.
  5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.
- F. Hub and Spigot Joints - Sanitary Pipe and Storm Pipe (Cast Iron and Stainless Steel Pipe):
1. Lead and Oakum Joints: Pack joint with oakum made of vegetable fiber, cotton, or hemp. Pour joint with molten lead up to top of hub. Ensure leak-free joints by working joint with inside and outside caulking irons.
  2. Compression Gasket Joints: Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.
- G. Solvent Weld Joints (PVC):
1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.
- H. Solvent Weld Joints (CPVC):
1. Make joints with a one-step process. Use CPVC cement conforming to ASTM F493. A primer is not required.
  2. If a primer is required by the Authority Having Jurisdiction, then a primer conforming to ASTM F656 shall be used.

### 3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.

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- B. Provide necessary connections at the start of individual sections of mains for adding chlorine.
- C. Before starting work, verify system is complete, flushed and clean.
- D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- E. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- F. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.
- G. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.
- H. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.
- I. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.
- J. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

### 3.12 SERVICE CONNECTIONS

- A. Provide new sanitary and/or storm sewer services. Before commencing work check invert elevations needed for sewer connections, confirm inverts and verify these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service with water meter with bypass valves. Provide sleeve in wall for service main per Section 22 0529.

**END OF SECTION 22 1000**

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**SECTION 22 1023  
NATURAL GAS AND PROPANE PIPING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Natural Gas Piping System.

**1.2 QUALITY ASSURANCE**

- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. All work shall be performed in accordance with the IPC.
- E. Design hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Nevada.

**1.3 REFERENCES**

- A. ANSI/AWS D1.1 - Structural Welding Code.
- B. ANSI AGA-LC1 - Standards for Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
- C. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- D. ASME - Boiler and Pressure Vessel Code - Section 9.
- E. ASME B1.20.1 - Pipe Threads, General Purpose.
- F. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
- G. ASME B16.5 - Pipe Flanges and Flanged Fittings.
- H. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- I. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
- J. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
- K. ASME B16.39 - Malleable Iron Threaded Pipe Unions.
- L. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.

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- M. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
- N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- O. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
- P. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
- Q. ASTM A197 - Standard Specification for Cupola Malleable Iron.
- R. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- S. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- T. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- U. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- V. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe.
- W. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
- X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- Y. NFPA 54 - National Fuel Gas Code.

### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section [22 05 00]. Include data on pipe materials, fittings, valves, and accessories.
- B. Test Reports: Provide results of piping system pressure test.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.
- B. Deliver and store valves in shipping containers with labeling in place.

### 1.6 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section [22 05 00] for the required natural gas piping system electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

## PART 2 - PRODUCTS

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### 2.1 NATURAL GAS (0 TO 125 PSI)

- A. Design Pressure: 125 psi. Maximum Design Temperature: 350°F
- B. Piping - 2" and Under:
  - 1. Pipe: Standard weight steel, threaded and coupled, ASTM A53.
  - 2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
  - 3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
  - 4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.
- C. Piping - 2" and Under:
  - 1. Pipe: Standard weight steel, plain end press connection sanded smooth, ASTM A53.
  - 2. Joints: Mechanical press connection.
  - 3. Fittings, Valves and Unions: ASTM A106 Grade A steel with zinc-nickel coating to reduce corrosion, with embedded HNBR sealing element. ANSI LC 4 approved.
  - 4. Manufacturers:
    - a. Conbraco "Apollo" (Powerpress)
    - b. Viega (Megapress)
- D. Piping - 2" and Under:
  - 1. Pipe: Corrugated stainless steel tubing, ASTM A240 Series 300 stainless steel, ANSI AGA-LC1.
  - 2. Jacket: UV resistant, electrically conductive polyethylene, color: black, ASTM E84 25-50 flame and smoke.
  - 3. Fittings: Brass with mechanical ends to fit tubing. ASME B1.20.1 threaded ends for connections to threaded pipes and components.
  - 4. Striker Plates: Minimum 16 gauge hardened steel, corrosion resistant, primed and zinc coated. Install to protect tubing from penetrations.
  - 5. Limits: 5 psi or less.
  - 6. Manufacturers:
    - a. TracPipe (Counterstrike)
    - b. Gastite (Flash Shield)
- E. Piping - 2" and Under:
  - 1. Pipe: Corrugated stainless steel tubing, ASTM A240 Series 300 stainless steel, ANSI AGA-LC1.

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2. Jacket: Polyethylene.
  3. Fittings: Brass with mechanical ends to fit tubing. ASME B1.20.1 threaded ends for connections to threaded pipes and components.
  4. Striker Plates: Minimum 16 gauge hardened steel, corrosion resistant, primed and zinc coated. Install to protect tubing from penetrations.
  5. Limits: 5 psi or less. For use only at termination to fixed outlets or equipment, maximum length: 48". Provide malleable iron, flange mounted, straight or 90 fitting at wall termination with maximum 12" length of tubing on inlet of flange.
  6. Manufacturers:
    - a. TracPipe
    - b. Gastite
    - c. Parker (Parflex)
    - d. Proflex (1 Yellow CSST)
- F. Piping - 2" and Under:
1. Pipe: Corrugated stainless steel tubing, ASTM A240 Series 300 stainless steel, ANSI AGA-LC1.
  2. Jacket: UV resistant, electrically conductive polyethylene, color: black, ASTM E84 25-50 flame and smoke.
  3. Sleeve: Polyethylene, pre-sleeved from factory with field installed vent tees and water/gas tight heat shrink cuffs on each end.
  4. Fittings: Brass with mechanical ends to fit tubing. ASME B1.20.1 threaded ends for connection to threaded pipes and components.
  5. Limits: 5 psi or less. Below ground, inside building.
  6. Manufacturer:
    - a. TracPipe (PS-II)
- G. Piping - 2-1/2" and Over:
1. Pipe: Standard weight steel, beveled ends, ASTM A53.
  2. Joints: Butt welded or flanged.
  3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade I, ANSI B16.9.
  4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5. Flange face seal weld (backweld) is required for slip-on flanges.
- H. Piping - All Sizes:

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1. Pipe: Polyethylene pipe, ASTM D2513, SDR 11.5.
  2. Joints: Fusion welded.
  3. Fittings: Socket type, ASTM D2683 or ASTM D2513.
  4. Limits: Use only below ground outside of buildings.
  5. Transition Riser (Polyethylene to Steel Transition):
    - a. Provide transition riser fitting by Central□□ or equal when offsetting from below grade polyethylene to above grade Schedule 40 black steel piping.
    - b. Joints: ASTM A53 Schedule 40 steel epoxy coated casing welded or threaded end; the polyethylene end shall be fusion welded.
- I. For Underground Gas Piping - Refer to paragraph "Underground Piping Protection."
- J. Shutoff Valves/Throttling Valves:
1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
  2. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.
    - a. Manufacturers:
      - 1) Apollo #80-100
      - 2) Nibco #T580-70-UL or #T585-70-UL
      - 3) Watts #B-6000
  3. PL-1: 2" and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port.
    - a. Manufacturers:
      - 1) Walworth #1700
      - 2) DeZurik #425, S-RS49
  4. PL-2: 2-1/2" thru 4", 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port.
    - a. Manufacturers:
      - 1) Walworth #1700F
      - 2) DeZurik #425, F-RS49



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5. PL-3: 6" and larger, 125# steam @ 450°F, 175# CWP, cast iron body, flanged, resilient faced plug, gear and handwheel operator, full port.

- a. Manufacturers:

- 1) Walworth #1707F
- 2) DeZurik #118, F-RS24

- K. Gas Seismic Valves:

1. Provide a valve consisting of a swing check valve arrangement with an acceleration-sensitive triggering mechanism. The trip mechanism shall consist of a steel ball resting on a tapered cup-shaped support. The trip mechanism shall be factory set and sealed. A sight glass shall be provided so that the Open or Closed indicator can be seen, and the trip mechanism status of the valve can be easily determined. The valve assembly shall be approved by the local authority, and meet the requirements of ANSI Z21.70 and ASCE 25-97. Refer to schedule for model number.

### 2.2 NATURAL GAS (126 TO 300 PSI)

- A. Design Pressure: 300 psi.

1. Maximum Design Temperature: 400°F

- B. Piping - 2" and Under:

1. Pipe: Extra strong seamless black steel, plain ends, ASTM A53, Grade B.
2. Joints: Socket welded.
3. Fittings: 3,000# CWP forged steel, socket weld, ASTM A105, Grade II, ANSI B16.11.
4. Unions: 3,000# CWP forged steel, socket weld ground joint, ASTM A105, Grade II.

- C. Piping - 2-1/2" and Over:

1. Pipe: Extra strong seamless black steel, beveled ends, ASTM A53, Grade B.
2. Joints: Butt welded or flanged.
3. Fittings: Extra strong seamless steel, butt weld type, ASTM A234, Grade WPB, ANSI B16.9.
4. Flanges: 300# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5. Weld neck type shall have bore to match pipe. Flange face seal weld (backweld) is required for slip-on flanges.

- D. For Underground Piping - Refer to paragraph "Underground Piping Protection."

- E. Shutoff Valves:

1. PL-11: 1-1/4" and under, 720# CWP, screwed, cast steel, lubricated type, UL labeled.

- a. Manufacturer:

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- 1) Walworth #1760
2. PL-12: 1-1/2" and over, 720# CWP, 300# flanged, cast steel, lubricated type, UL labeled.
  - a. Manufacturer:
    - 1) Walworth #1760F

### 2.3 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:
  1. Gases:
    - a. 1/4" - 2": 1/32" perforations
    - b. 2-1/2" - 10": 3/64" perforations
    - c. 12" - 18": 1/16" perforations
- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use iron body strainers in ferrous piping.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories .
- D. Connect to all equipment with flanges or unions.
- E. After completion, fill, clean, and treat systems. Refer to Section 232500 for treatment.

### 3.2 TESTING PIPING

- A. Low Pressure - Up to 1 psi:
  1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
- B. High Pressure - Above 1 psi:
  1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
- C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

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### 3.3 CLEANING PIPING

#### A. Assembly:

1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

### 3.4 INSTALLATION

- A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
- B. Install piping to conserve building space, and not interfere with other work.
- C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for access to valves and fittings.
- G. Provide access doors where valves are not exposed.
- H. Prepare pipe, fittings, supports, and accessories for finish painting.
- I. Install valves with stems upright or horizontal, not inverted.
- J. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
- K. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
- L. Seal pipes passing through exterior walls with a wall seal per Section 230529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.

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- M. Refer to Section 230500 for Excavation, Fill, Backfill and Compaction requirements.
- N. All vertical pipe drops to equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.
- O. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

### 3.5 BONDING AND GROUNDING

- A. Each above ground portion of a corrugated stainless steel tubing gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream corrugated stainless steel tube fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of corrugated stainless steel tubing shall be bonded in accordance with this section.
- B. Each above ground portion of a gas piping system, other than corrugated stainless steel tubing systems, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than corrugated stainless steel tubing, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- C. Gas piping shall not be used as a grounding conductor or electrode.
- D. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

### 3.6 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.
- B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.
- F. Use full and double lengths of pipe wherever possible.
- G. Cut all pipe to exact measurement and install without springing or forcing.

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- H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

### 3.7 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.
- B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.
- C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

### 3.8 BRANCH CONNECTIONS

- A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.
- B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.
- C. Use of forged weld-on fittings is also limited as follows:
  - 1. Must have at least same pressure rating as the main.
  - 2. Header or main must be 2-1/2" or over.
  - 3. Branch line is at least two pipe sizes under header or main size.
- D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

### 3.9 JOINING OF PIPE

- A. Threaded Joints:
  - 1. Ream pipe ends and remove all burrs and chips.
  - 2. Protect plated pipe and valve bodies from wrench marks when making up joints.
  - 3. Apply gas-rated Teflon tape or thread compound to male threads.
- B. Welded Joints:
  - 1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
  - 2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.

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3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.

### **3.10 PAINTING EXPOSED PIPE**

- A. Paint all outdoor exposed [natural gas][propane] piping the color selected by Owner or Architect/Engineer.

### **3.11 SERVICE CONNECTIONS**

- A. Provide new gas service complete with gas meter and regulators. Verify gas service pressure with the Utility Company.

**END OF SECTION 22 1023**

**SECTION 22 1030  
PLUMBING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Cleanouts.
- B. Traps.
- C. Trap Seals and Primers.
- D. Floor Drains and Sinks
- E. Roof Drains.
- F. Backflow Preventers.
- G. Strainers.
- H. Unions.
- I. Balancing Valves.
- J. Water Hammer Arresters.
- K. Dielectric Fittings (Connections Between Dissimilar Metals).
- L. Air Vents.
- M. Drain Valves.
- N. Relief Valves.
- O. Compressed Air Filters.
- P. Compressed Air Condensate Traps.

**1.2 QUALITY ASSURANCE**

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- B. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

**1.3 REFERENCES**

- A. ANSI A112.21.1 - Floor Drains.
- B. ANSI A112.21.2 - Roof Drains.
- C. ASSE 1010 - Water Hammer Arresters.

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- D. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.
- E. ANSI A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers.
- F. ASME A112.6.9 - Siphonic Drain Test; The American Society of Mechanical Engineers.
- G. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.
- H. ANSI 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering.
- I. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 1.
- J. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.
- K. ASSE 1047 - Reduced Pressure Detector Assemblies.
- L. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- M. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- N. PDI WH-201 - Water Hammer Arresters.

### **PART 2 - PRODUCTS**

#### **2.1 CLEANOUTS**

- A. Provide cleanouts as shown and specified on the drawings as well as required by code.
- B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
- C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.
- D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

#### **2.2 YARD CLEANOUTS**

- A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.
- B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

#### **2.3 TRAPS**

- A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:
  - 1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.



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2. Insulated at accessible lavatories.
  3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
  4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.
- B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.
- C. Each trap shall be completely filled with water at the end of construction but before building[ space] turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water and a 1/2" minimum layer of mineral oil.

### 2.4 TRAP SEALS AND PRIMERS

- A. Provide trap seals as specified on the drawings.

### 2.5 FLOOR DRAINS AND SINKS

- A. Floor drains and sinks shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.
- B. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

### 2.6 ROOF DRAINS

- A. Provide roof drains as shown and specified on the drawings as well as required by code.

### 2.7 STRAINERS

- A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:
1. Air:
    - a. 1/4" - 2": 1/32" perforations
    - b. 2-1/2" - 10": 3/64" perforations
    - c. 12" - 18": 1/16" perforations
  2. Water:
    - a. 1/4" - 2": 3/64" perforations
    - b. 2-1/2" - 10": 1/16" perforations
    - c. 12" - 18": 1/8" perforations
  3. Lube, Hydraulic, No. 6 Fuel and Waste Oils:
    - a. 1/4" - 2": 3/16" perforations

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- b. 2-1/2" - 10": 3/16" perforations
  - c. 12" - 18": 3/16" perforations
- B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.
- C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

### 2.8 UNIONS

- A. Copper pipe - wrought copper fitting - ground joint.
- B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.
- C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

### 2.9 BALANCING VALVE

- A. Rated for 125 psi working pressure and 250°F operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1' and 2' water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.
- B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.
- C. Flow rate of 0.5 GPM or larger: Valves in copper piping shall be brass or bronze. Acceptable Manufacturers: Flow Design "Accusetter", Preso "B+", Armstrong "CVB", Bell & Gossett "Circuit Setter Plus", Griswold "Quickset", Gerand "Balvalve Venturi" or Nibco Globe Style balancing valve.
- D. Flow rate less than 0.5 GPM: Valves in copper piping shall be brass or bronze. Cv value shall be less than 1.0 when valve is completely open, and minimum balanceable flow rate shall not exceed 0.1 GPM with a meter reading of at least 2.5 feet. Acceptable manufacturers: Bell & Gossett "Circuit Setter RF", Flow Design, Preso, Armstrong, Griswold, Gerand, or Nibco balancing valve.
- E. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer's standard meters.

### 2.10 BALANCING VALVE WITH FLOW INDICATION

- A. Balancing valve with built-in visual flow meter, adjustable flow control with memory stop feature, [external temperature gauge], and tight shutoff.
- B. Maximum working pressure: 150 psi. Maximum Temperature 230°F. Maximum differential pressure: 15 psi. Maximum inlet temperature: 195°F.
- C. Low-lead brass valve, stainless steel springs, EPDM seals.
- D. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on the self-contained visual flow meter.
- E. Acceptable Manufacturers:

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1. Caleffi 132 Series
2. Watts CSD [(provide with separate external temperature gauge)]

### 2.11 AUTO-THERMOSTATIC ADJUSTABLE BALANCING VALVE

- A. Adjustable thermostatic balancing valve for domestic hot water recirculation circuits. Dry well with temperature gauge and probe. Internal thermostatic balancing cartridge automatically modulates flow to ensure constant temperature. Adjustable from 95°F to 140°F. Set temperature to [5°F][10°F] below system temperature.
- B. Sizes: 1/2" and 3/4" with NPT female connections. Flow rating: 2.1 Cv maximum, 0.23 Cv minimum, 0.52 Cv design. Suitable fluid: Water.
- C. Maximum working pressure: 230 psi. Maximum differential pressure: 15 psi. Maximum inlet temperature: 195°F.
- D. Low-lead brass valve, stainless steel and copper adjustable thermostatic cartridge, EPDM hydraulic seals, stainless steel springs, adjustment knob with temperature adjustment scale, and tamperproof adjustment locking screw with probe dry-well port[ with bypass valve for thermal disinfection function][ with shutoff valve][ and check valve][ with temperature gauge. If manufactured unit does not contain integral gauge, Contractor shall install external gauge immediately upstream of unit].
- E. Acceptable Manufacturers:
  1. Caleffi Thermostat 116
  2. Acorn TZV-1
  3. B&G Temp Setter

### 2.12 WATER HAMMER ARRESTERS

- A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.
- B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.

### 2.13 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

- A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.
- B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.
- C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
  1. Iron, steel, and stainless steel connected to each other.

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2. Brass, copper, and bronze connected to each other.
  3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.
- D. Dielectric protection is required at connections to equipment of a material different than the piping.
- E. Screwed Joints (acceptable up to 2" size):
1. Dielectric waterway rated for 300 psi CWP and 225°F.
  2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.
- F. Flanged Joints (any size):
1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
  2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
  3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
  4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
  5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
  6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

### 2.14 AIR VENTS

- A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.
- B. At end of main and other points where large volume of air may be trapped - Use 1/4" globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4" discharge pipe turned down with cap.

### 2.15 DRAIN VALVES

- A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

### 2.16 RELIEF VALVES

- A. RV-3: (Compressed Air) Spring loaded disc type, cast iron or steel body, stainless steel disc, side outlet and lifting lever, 250# CWP. Acceptable Manufacturers: Consolidated Div. of Dresser Ind.

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Series 1900, Kunkle #463, Keckley Type 41.

- B. RV-4: (Domestic Hot Water) Pressure and Temperature relief, cast bronze body and internal parts, stainless steel spring, test lever, threaded inlet and outlet. Maximum setting of 150 psi and 210°F temperature. Capacities ASME certified and labeled. Acceptable Manufacturers: Cash Series FV, Watts #40, #120, #N240, #340.

### 2.17 COMPRESSED AIR FILTERS

- A. Filters shall have a stainless steel sleeve, micro-glass media with epoxy coating, elastomeric filter to housing seal and sealed end caps.
- B. Filters shall be capable of removing the following:
  - 1. All solids 3 microns and larger.
  - 2. Liquids up to 25,000 ppm by weight.
  - 3. 99% of water droplets.
  - 4. 40% of oil aerosols.
- C. Provide a differential pressure alarm for each filter. Range shall be adjustable from 10 to 35 psi differential at 100 psig.
- D. Acceptable Manufacturer: Hankison.

### 2.18 COMPRESSED AIR CONDENSATE TRAPS

- A. Furnish and install traps of the type and capacity shown on the drawings.
- B. Traps shall be mechanically actuated with stainless steel construction, and 10-300 psig working pressure.
- C. Acceptable Manufacturer: Hankison Series 505.

## PART 3 - EXECUTION

### 3.1 INSTALLATION AND APPLICATION

- A. Coordinate construction to receive drains at required invert elevations.
- B. Install all items per manufacturer's instructions.
- C. Water Hammer Arresters:
  - 1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
  - 2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.

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3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.

### D. Cleanouts:

1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet[ in pipe less than 6" size .
2. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
3. Extend cleanouts to the floor with long sweep elbows.
4. Install a full size, two-way cleanout within 5 feet of the foundation or outside of building.
5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

### E. Yard Cleanouts:

1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.

### F. Trap Seals and Primers:

1. Install [trap guard]on drains not receiving continuous discharge and subject to drying out.

### G. Floor Drains and Floor Sinks:

1. Drains in upper floors shall have a flashing of EPDM or similar membrane sheet. The sheet shall be at least 36" X 36" square with the drain in the center. Clamp membrane in auxiliary clamping ring of floor drain. Membrane is not required if upper floor construction is single pour, cast-in-place concrete.
2. Use alternate sealing method when installing drains in existing floor slabs.
3. Coordinate sloping requirements with the architectural plans and specifications.
4. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.
5. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain or sink begins. Proceeding with installing a floor drain or sink raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.

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### H. Roof Drains:

1. Roof drains shall have bearing pans.
2. Provide auxiliary support steel under drains as required to prevent movement of the drain.
3. All roof drains shall have underdeck clamps.
4. Drains in built-up roofing systems shall have a 36" x 36", 3 lb density lead sheet flashing.

### I. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

**END OF SECTION 22 1030**

**SECTION 22 1519  
COMPRESSED AIR SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Compressed Air Piping (Non-Medical)
- B. Condensate Piping
- C. Shutoff Valves
- D. Check Valves
- E. Automatic Drain Valves
- F. Safety Relief Valves
- G. Strainers
- H. Filter
- I. Filter / Regulator
- J. Lubricator
- K. Pressure Gauge
- L. Pressure Flow Controller
- M. Flexible Connections
- N. Hose Reels
- O. Point-of-Use Couplings
- P. Compressors
- Q. Compressor Controls
- R. Dryers
- S. Oil-water Separators
- T. Air Receiver
- U. Lockout Trim
- V. Valve Operators
- W. Valve Connections

**1.2 QUALITY ASSURANCE**



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- A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
- D. Pipe hangers and supports shall be spaced per 2018 IPC, Table 313.3, as applied to each pipe system listed. Refer to Section 22 0529 for hanger and support components. Seismic supports shall be submitted as a deferred approval using OPM guidelines. Shop drawings shall be submitted for review to the AHJ: State, local or agency reviewing the project. Upon approval, these shop drawings shall be included in the record set.

### 1.3 REFERENCES

- A. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- B. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
- F. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- G. ANSI/ASTM B32 - Solder Metal.
- H. ANSI/AWS D1.1 - Structural Welding Code.
- I. ASME - Boiler and Pressure Vessel Code.
- J. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- K. ASTM A181 - Carbon Steel Forgings for General Purpose Piping.
- L. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- M. ASTM A270 - Seamless and Welded Austenitic and Ferritic/Austenitic Stainless Steel Sanitary Tubing.
- N. ASTM A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- O. ASTM A351 - Castings, Austenitic for Pressure-containing Parts.
- P. ASTM A403 - Wrought Austenitic Stainless Steel Piping Fittings.
- Q. ASTM B88 - Seamless Copper Water Tube.
- R. ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

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S. ASTM B306 - Copper Drainage Tube (DWV).

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

### 1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 220500 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

## PART 2 - PRODUCTS

### 2.1 COMPRESSED AIR PIPING (NON-MEDICAL)

A. Design Pressure: 125 psi; Maximum Design Temperature: 150°F

B. Underground Piping - All sizes:

1. Pipe: Standard weight carbon steel polyethylene sheath, beveled ends, ASTM A53.
2. Joints: Butt welded. (All welded joints shall be ground.) Sheath joints shall be with a thermally fitted shrinking sleeve, applied with factory approved shrinking device.
3. Fittings: Standard weight seamless steel, butt weld type, long radius, ASTM A234, Grade WPB, ANSI B16.9.

C. Piping - 2" and Under:

1. Pipe: Standard weight carbon steel, threaded and coupled, ASTM A53.
2. Joints: Screwed.
3. Fittings: 150# steam 300# CWP, black malleable iron, banded, ASTM A47, ASTM A197, ANSI B16.3.
4. Unions: 250# steam - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.

D. Piping - 2-1/2" and Over:

1. Pipe: Standard weight carbon steel, beveled ends, ASTM A53.
2. Joints: Butt welded and flanged. (All welded joints shall be ground, primed, and painted.)
3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade WPB, ANSI B16.9.
4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5.

E. Piping - 2-1/2" and Under:

1. Pipe: Rigid aluminum 6063-T5 as defined in ASTM B241. Pipe shall be blue powder coated.

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2. Joints, Fittings and Valves: Aluminum pipe manufacturers standard push-to-connect fittings that will provide a leak-free guarantee.
  3. Pipe Attachments for Hanging: Aluminum pipe manufacturers fixing clips. Fixing clips shall allow axial movement of the pipe to take into account expansion and contraction.
- F. Piping - 6" and Under:
1. Pipe: Standard weight carbon steel, grooved ends and coupled.
  2. Joints: Mechanically coupled grooved type.
  3. Mechanical Couplings: Ductile iron, ASTM A536, Grade 624512, grooved type.
  4. Fittings: Ductile iron, ASTM A536, Grade 624512, alkyd enamel finish with grooved ends or 125# steam - 175# CWP.
  5. Gaskets: Manufacturer shall provide gaskets rated for the intended service.
- G. Piping - 2" and Under:
1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
  2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
  3. Fittings: Wrought copper solder joint, ANSI B16.22.
- H. Piping - All Sizes:
1. Pipe: Standard weight 304 stainless steel, threaded and coupled, beveled ends square ends, ASTM A312.
  2. Joints: Screwed or Butt weld and flanged, socket weld. All welded joints shall be ground and polished.
  3. Fittings: Schedule 40 class, 316L Stainless Steel, butt weld beveled ends, socket weld. ASTM A351, ASTM A403, ANSI B16.5.
- I. Tubing - All Sizes:
1. Tube: Sanitary tube, 304 stainless steel, ASTM A270, interior and exterior surface finish 32Ra, meeting 3A standards.
  2. Joints: TIG welded meeting 3A standards. All welded joints shall be polished to surface finish of 32Ra.
  3. Fittings: Sanitary tube, 304 stainless steel, ASTM A270, interior and exterior surface finish 32Ra, meeting 3A standards, sanitary clamp ends where indicated.

### 2.2 CONDENSATE PIPING

- A. Design Pressure: 125 psi; Maximum Design Temperature: 150°F

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### B. Piping - 2" and Under:

1. Tubing: Type DWV hard drawn seamless copper tube, ASTM B306.
2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
3. Fittings: Wrought copper solder joint, ANSI B16.22.

## 2.3 SHUTOFF VALVES

### A. Ball Valves:

1. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, vented, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals.
  - a. Manufacturers:
    - 1) Apollo #77C-140
    - 2) Stockham #S-255-FB-P-UL
    - 3) Milwaukee #BA-400
    - 4) Watts
    - 5) Nibco #585-70-66
    - 6) National Utilities Co.
    - 7) RUB
  - b. NOTES: Provide lockout trim for all valves.

### B. Butterfly Valve:

1. BF-1:
  - a. Mechanically coupled grooved end valves are acceptable if they have the features listed above.
    - 1) Manufacturers:
      - (a) Victaulic #608
      - (b) Nibco GD4765
    - 2) NOTES: Provide lockout trim for all valves.

## 2.4 CHECK VALVES

- A. CK-5: 2" and under, 250# CWP, screwed, all iron, horizontal swing.

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1. Manufacturers:

- a. Crane #346-1/2

### 2.5 AUTOMATIC DRAIN VALVES

#### A. Zero Loss Drain:

1. Electronic Operation: Electronic level control to monitor liquid level in the drain. Electronic control opens drain valve to discharge condensate and closes before compressed air is lost. 120VAC, alarm mode with visual signal and potential-free contact.

- a. Manufacturers:

- 1) Gardner Denver EEDS series
- 2) Parker Finite series
- 3) Ingersoll-Rand ENL series
- 4) Quincy Q-MAT series

2. Pneumatic Operation: Automatic discharge of condensate, pneumatic control of valve, on-demand operation.

- a. Manufacturers:

- 1) Gardner Denver NA750 series
- 2) Ingersoll-Rand PNLD series
- 3) Quincy QDD series

3. Float Operation: Discharge of condensate with float operation, on-demand operation.

- a. Manufacturers:

- 1) Gardner Denver DS1 series
- 2) SMC AD402-A series

### 2.6 SAFETY RELIEF VALVES

- #### A. Bronze body, test lever, metal seat, bronze disc, ASME Section VIII Air/Gas code stamped, factory set pressure as scheduled.

1. Manufacturers:

- a. Kunkle Series 6000
- b. Approved equal

### 2.7 STRAINERS

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- A. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi steam @ 350°F, 175 psi CWP @ 150°F.
  - 1. Manufacturers:
    - a. Armstrong #A1FL
    - b. Metraflex #TF
    - c. Mueller Steam Specialty Co.#751
    - d. Sarco #CI-125
    - e. Watts #77F-D
- B. ST-4: Cast iron body, screwed ends, screwed cover, 250# steam @ 406°F, 300# CWP @ 150°F.
  - 1. Manufacturers:
    - a. Armstrong #A1SC
    - b. Metraflex #SM
    - c. Mueller Steam Specialty Co. #11
    - d. Sarco #IT

### 2.8 FILTER

- A. Particulate: Aluminum or brass body, 125 psi minimum rating, compact modular assembly, NBR seals, metal bowl with poly sight gauge,[ no drain][ manual drain][ automatic drain], cellulose cartridge filter capable of removing liquids and solids of 5 microns or larger, capacity shall be for rated flow of equipment ASCO Series 65X.
- B. Coalescing: Aluminum or brass body, 125 psi minimum rating, compact modular assembly, NBR seals, metal bowl with poly sight gauge,[ no drain][ manual drain][ automatic drain], cellulose cartridge filter capable of removing liquids and solids of [0.3][0.01] microns or larger, capacity shall be for rated flow of equipment ASCO Series 65X.

### 2.9 FILTER / REGULATOR

- A. Adjustable: Diaphragm type, air loaded, tight closing single seat, aluminum or brass body[ with integral particulate filter and bowl].
  - 1. Manufacturer:
    - a. ASCO Series 65X
- B. Non-adjustable: Diaphragm type, air loaded, tight closing single seat, aluminum or brass body[ with integral particulate filter and bowl], factory set at [Insert] psi.
  - 1. Manufacturer:

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- a. ASCO Series 65X

### 2.10 LUBRICATOR

- A. 1/2" port size, NPTF port type, aluminum or brass body, compact modular assembly, NBR seals, 125 psi minimum rating, poly bowl with sight gauge and metal guard, ASCO Series 65X.

### 2.11 PRESSURE GAUGE

- A. Accuracy Grade 1A (+/- 1% full range), dry for air service, with stainless steel or brass case, non-shatterable safety glass, pressure blowout back, 3-1/2" minimum diameter dial, dial range 0 psi to 200 psi, ASME B40.100 compliant.

1. Manufacturer:

- a. Ashcroft 1009

### 2.12 PRESSURE FLOW CONTROLLER

- A. Flow controller shall provide consistent line pressure +/-1% of setpoint while adjusting airflow to meet demand.
- B. Inlet pressure range 50 psi to 250psi, setpoint pressure range 40 psi to 225 psi, maximum pressure rating 200 psi, maximum operating temperature 150°F

- C. Approved Manufacturers:

1. Quincy
2. Gardner Denver
3. Ingersoll-Rand
4. Kaeser

### 2.13 FLEXIBLE CONNECTIONS

- A. Vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze end connections, suitable for pressure indicated, length as recommended by manufacturer not less than 18".
- B. Hose whip, rubber hose, line size, minimum 250 psi working pressure rating, brass crimped NPT fittings, 36" maximum length.

### 2.14 HOSE REELS

- A. Steel heavy duty construction, open type, spring return, 4-way hose rollers, 3/8" x 50' rubber hose, adjustable hose stop, 250 psi minimum rating, adjustable guide arm for multiple mounting positions.

1. Manufacturers:

- a. Reelcraft 7000 & HD70000 series
- b. Coxreels SH series

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- c. Hannay N700 series

### 2.15 POINT-OF-USE COUPLINGS

- A. Non-exhausting Type: All brass construction, 1/4" body size, 125 psi minimum working pressure rating, general purpose, manual connect, industrial interchange style, coupling shall have female NPT connection with automatic shutoff, plug shall have male NPT connection.
  - 1. Manufacturers:
    - a. Milton, Parker 20 Series
    - b. Approved equal
- B. Exhausting Type: All brass construction, 1/4" body size, 125 psi minimum working pressure rating, general purpose, push-to-connect, industrial interchange style, coupling shall have female NPT connection with automatic shutoff, plug shall have male NPT connection and ball check to bleed pressure from hose.
  - 1. Manufacturers:
    - a. Parker E-z-mate series

### 2.16 COMPRESSORS

- A. Reciprocating:
  - 1. Simplex or Duplex compressor unit consisting of single-stage or two-stage, splash lubricated, air-cooled or water-cooled motor driven compressor, integral air receiver, rubber isolators, and operating controls.
  - 2. Compressor Construction:
    - a. Construct compressor with cast iron housing and head, heat treated forged steel or ductile iron shaft, aluminum alloy connecting rods, aluminum pistons with non-lubricated carbon rings, and high strength alloy suction and discharge valves. Statically and dynamically balance rotating parts.
    - b. Provide oil pressure switch to shut down compressor.
    - c. Provide automatic capacity reduction equipment consisting of suction valve unloaders, and lifting mechanism operated by oil pressure, gas discharge pressure, or solenoid valve centrifugal force. Provide for unloaded compressor start.
    - d. Mount motor and compressor on one-piece ribbed cast iron or welded steel base with provision for V belt adjustment.
    - e. [Provide thermostatically controlled water valve on compressor to maintain water temperature through compressor at 98°F to 109°F.
    - f. The compressor modules and motors shall be fully isolated from the main compressor base by means of a four-point; heavy-duty seismic-restrained isolation system for a minimum of 95%



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isolation efficiency. Engineering data shall be provided supporting isolation efficiency and equal weight distribution between supports. Pumps not having this feature shall have an inertia base sized for that system installed at this contractor's expense.

### 3. Acceptable Manufacturers:

- a. Curtis
- b. Quincy
- c. Gardner-Denver
- d. Ingersoll Rand

### B. Rotary Screw:

#### 1. Oil Lubricated:

- a. Direct drive, oil flooded, single-stage or two-stage, air-cooled or water-cooled, variable speed or fixed speed, TEFC motor, with enclosure and without enclosure, air/oil filter with 3 ppm maximum carryover, air intake filter, aftercooler.
- b. Acceptable Manufacturers:
  - 1) Gardner-Denver
  - 2) Curtis
  - 3) Quincy
  - 4) Atlas Copco
  - 5) Ingersoll Rand

#### 2. Oil-Free:

- a. ISO 8573-1 Class 0 certified, certified silicone free, direct drive, single-stage or two-stage, air-cooled or water-cooled, variable speed or fixed speed, TEFC motor with driver, packaged system with common base frame, with enclosure and without enclosure, aftercooler, air intake filter.
- b. Acceptable Manufacturers:
  - 1) Gardner-Denver
  - 2) Quincy
  - 3) Atlas Copco
  - 4) Ingersoll-Rand

#### 3. Oil-Less:

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- a. ISO 8573-1 Class 0 certified, certified silicone free, direct drive, variable speed, water cooled, TEFC motor with driver, packaged system with common base frame, with enclosure, air intake filter.
  - b. Acceptable Manufacturers:
    - 1) Gardner-Denver
- C. Rotary Scroll:
- 1. Oil-Less:
    - a. ISO 8573-1 Class 0 certified, certified silicone free, direct drive, variable speed or fixed speed, single-stage or two-stage, air-cooled or water-cooled, TEFC motor, with enclosure, air intake filter.
    - b. Acceptable Manufacturers:
      - 1) Gardner-Denver
      - 2) Quincy
      - 3) Atlas Copco
- D. Centrifugal:
- 1. Oil-Free:
    - a. ISO 8573-1 Class 0 certified, gear drive or direct drive, variable speed or fixed speed, single-stage, two-stage, or multi-stage, air-cooled or water-cooled, TEFC motor, with enclosure, air intake filter.
    - b. Acceptable Manufacturers:
      - 1) Ingersoll-Rand
      - 2) Atlas Copco
  - 2. Oil-Less:
    - a. ISO 8573-1 Class 0 certified, certified silicone free, gear drive or direct drive, variable speed or fixed speed, single-stage, two-stage, or multi-stage, air-cooled or water-cooled], TEFC motor, with enclosure, air intake filter.
    - b. Acceptable Manufacturers:
      - 1) Gardner-Denver
      - 2) Ingersoll-Rand

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

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- A. Install all products per manufacturer's recommendations.
- B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Connect to equipment with flanges or unions.

### 3.2 TESTING PIPING

- A. Compressed Air Piping, Condensate Piping:
  - 1. Test piping using compressed air per ASME 31.9 requirements.
  - 2. Test piping at 125% of normal operating pressure in accordance with ASME 31.9.
  - 3. Piping shall hold this pressure for one hour with no drop in pressure.

### 3.3 CLEANING PIPING

- A. Assembly:
  - 1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
  - 2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
  - 3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
  - 4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.
- B. Air Blow:
  - 1. Blow out pipe and components with clean compressed air. Instrument air lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blowout points is clean. Use 80-90 psig pressure unless otherwise indicated.

### 3.4 INSTALLATION

- A. General Installation Requirements:
  - 1. Provide dielectric connections between dissimilar metals.

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2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
  3. Group piping whenever practical at common elevations.
  4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
  5. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
  6. Seal pipes passing through exterior walls with a wall seal per Section 22 0529. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
- B. Installation Requirements In Electrical Rooms:
1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- C. Valves/Fittings and Accessories:
1. Install shutoff valves that permit the isolation of each equipment connection without isolating any equipment or portion of the system, unless noted otherwise.
  2. Provide clearance for installation of insulation and access to valves and fittings.
  3. Provide access doors for concealed valves and fittings.
  4. Install valve stems upright or horizontal, not inverted.

### 3.5 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.
- C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.
- D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.
- E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.
- F. Make changes in direction of pipes only with fittings. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

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- G. Provide flanges or unions at all final connections to equipment, traps and valves.
- H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.
- I. Use full and double lengths of pipe wherever possible.
- J. Unless otherwise indicated, install all piping, including shutoff valves, filters, and regulators, to equipment at line size with reduction in size being made only at control valve or equipment.
- K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
- L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.
- M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane to prevent carryover of condensate and foreign matter.
- N. Do not use geotextile fabric with footing tile if silt content of soil exceeds 40% or if clay content exceeds 50%. The fabric shall be installed around 1" river rock or 2" limestone.

### 3.6 DRAINING AND VENTING

- A. Unless otherwise indicated on the drawings, all condensate and compressed air lines, including branches, shall pitch 1" in 40 feet in the direction of airflow to low points for complete drainage, removal of condensate.
- B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.
- C. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.
- D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.
- E. Provide air vents at high points and wherever else required to eliminate air in all condensate piping systems.

### 3.7 BRANCH CONNECTIONS

- A. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- B. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.

**END OF SECTION 22 1519**

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**SECTION 22 3000  
PLUMBING EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Water Heaters.

**1.2 QUALITY ASSURANCE**

- A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:
  - 1. American Gas Association (AGA).
  - 2. National Sanitation Foundation (NSF).
  - 3. American Society of Mechanical Engineers (ASME).
  - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
  - 5. National Electrical Manufacturers' Association (NEMA).
  - 6. Underwriters' Laboratories (UL).
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.
- C. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

**1.3 REFERENCES**

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASME Section 8D - Pressure Vessels.
- C. ANSI Section 21.10.1 or Section ANSI 21.10.3 - Gas Water Heaters Ratings 75,000 BTU per Hour and Less.
- D. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
- E. ANSI/NFPA 54 - National Fuel Gas Code.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- H. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.
- I. UL 174 - Household Electric Storage Tank Water Heaters.

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### 1.4 SUBMITTALS

- A. Submit shop drawings under provisions of Section 22 0500.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Include heat exchanger dimensions, size of tappings, and performance data.
- D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.
- F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.
- G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.
- H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- I. Submit certification that water heaters, water softeners, pressure booster system, accessories, and components will withstand seismic forces defined in Section 22 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
  - 2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
  - 3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- J. Submit a current water analysis from the actual water source serving the project site for softening equipment verification before sending shop drawings to the Architect/Engineer.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

### 1.6 REGULATORY REQUIREMENTS

- A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.
- B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.
- C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

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**PART 2 - PRODUCTS**

**2.1 WATER HEATERS**

- A. All water heaters shall be as scheduled on the drawings.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install all items in accordance with manufacturer's instructions.

**3.2 WATER HEATER INSTALLATION**

- A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 220529.
- B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.
- D. Install gas water heaters according to NFPA 54.

**END OF SECTION 22 3000**



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**SECTION 22 4000  
PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. All plumbing fixtures.

**1.2 REFERENCES**

- A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
- D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
- E. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- F. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
- G. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- H. ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.
- I. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- J. ASSE 1002 - Water Closet Flush Tank Ball Cocks.
- K. Americans with Disabilities Act (ADA), Title III.
- L. The Energy Policy Act (EPAct) of 2005.

**1.3 SUBMITTALS**

- A. Submit product data under provisions of Section 22 0500. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
- B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.
- D. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

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- A. Wall Hung Fixture Carriers:
  - 1. Material: All Metal, ASME/ANSI A112.6.1M.
  - 2. Manufacturers:
    - a. Zurn
    - b. Smith
    - c. Wade
    - d. Josam
    - e. Watts
    - f. Mifab.
  - 3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings.
- B. All fixtures shall be as scheduled on the drawings.
- C. All china shall be from the same manufacturer where possible.
- D. All lavatory and sink trim shall be from the same manufacturer where possible.
- E. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. General Installation Requirements:
  - 1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
  - 2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
  - 3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.
  - 4. Install components level and plumb.
  - 5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Joint Sealant" requirements. Color to match fixture.
  - 6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Joint Sealant"

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requirements.

7. Refer to Architectural Drawings for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

### B. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

### C. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.
2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

### D. ADA Accessible Exposed Sink and Lavatory Trim:

1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

### E. ADA Accessible Water Closet Requirements:

1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

### F. Bathtubs and Shower Requirements:

1. All acrylic and fiberglass bathtubs and showers shall have a non-shrink grout or manufacturer-approved material installed between the finished floor and floor of the fixture to prevent damage caused by deflection.
2. All rough-in pockets for showers and tubs located in basement floor installations shall be filled in with concrete and sealed tight.

## 3.2 ADJUSTING AND CLEANING

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- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

### 3.3 FIXTURE ROUGH-IN SCHEDULE

- A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

**END OF SECTION 22 4000**

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**SECTION 23 0500  
BASIC HVAC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

**1.2 SCOPE OF WORK**

- A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.
- B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.
- C. Separate contracts will be awarded for the following work:
- D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.
- F. Scope of Work:
  - 1. Plumbing Work: Refer to Section 22 0500 - Basic Plumbing Requirements.
  - 2. Heating Work shall include, but is not necessarily limited to:
    - a. Furnish and install heating hydronic boilers and accessories.
    - b. Furnish and install complete heating water system including pumps, piping, insulation, air control equipment, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
    - c. Furnish and install complete gas piping system including all meter requirements.
    - d. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
    - e. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
    - f. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 0550.

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- g. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - h. Complete all applicable tests, certifications, forms, and matrices.
3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:
- a. Furnish and install built-up air handling units complete with louvers, dampers, filters, coils, fans, motors, housing, and vibration isolation.
  - b. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
  - c. Furnish and install air-cooled condensing units and curbs.
  - d. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
  - e. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
  - f. Furnish and install combustion air louver, damper, and ductwork.
  - g. Furnish and install complete fume hood exhaust systems including fans, ductwork, and fittings.
  - h. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
  - i. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
  - j. Furnish and install gas flues, stacks, and breechings.
  - k. Furnish and install all temperature control systems.
  - l. Furnish and install all fire dampers.
  - m. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 0550.
  - n. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - o. Complete all applicable tests, certifications, forms, and matrices.
4. Temperature Control Work shall include, but is not necessarily limited to:
- a. Furnish and install a complete temperature control system as specified in Section 230900.
  - b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.

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- c. Furnish automatic control valves and dampers for installation by others.
  - d. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 230550.
  - e. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
  - f. The temperature controls will be provided by the Owner, separate from this work. This Contractor shall install all devices so noted in Section 23 0900.
5. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:
- a. Furnish complete testing, adjusting, and balancing as specified in Section 230593, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.
  - b. Complete all applicable tests, certifications, forms, and matrices

### 1.3 OWNER FURNISHED PRODUCTS

- A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.
- B. This Contractor shall make all mechanical system connections shown on the drawings or as required for fully functional units.
- C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

### 1.4 WORK SEQUENCE

- A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.
- B. Itemize all work and list associated hours and pay scale for each item.

### 1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

- A. Definitions:
  - 1. "Mechanical Contractors" refers to the following:
    - a. Plumbing Contractor.
    - b. Heating Contractor.
    - c. Air Conditioning and Ventilating Contractor.
    - d. Temperature Control Contractor.

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- e. Fire Protection Contractor.
  - f. Testing, Adjusting, and Balancing Contractor.
2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
  3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
  4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
  5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
    - a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.
  6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
  7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

**B. General:**

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The



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Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
  - a. Light fixtures.
  - b. Gravity flow piping, including steam and condensate.
  - c. Electrical busduct.
  - d. Sheet metal.
  - e. Electrical cable trays, including access space.
  - f. Sprinkler piping and other piping.
  - g. Electrical conduits and wireway.

### C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
  - a. Burners.
  - b. Condensing Units.
  - c. Makeup Air Units.
  - d. Gas Trains.
2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Subcontractor's Responsibility:
  - a. Wiring of all devices needed to make the Temperature Control System functional.

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- b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Subcontractor.
  - c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- D. Electrical Contractor's Responsibility:
1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
  2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
  3. Provides motor control and temperature control wiring, where so noted on the drawings.
  4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
  5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
  6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

### 1.6 COORDINATION DRAWINGS

#### A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-

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mounted devices, and any item that may impact coordination with other disciplines.

- d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
    - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
  3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

### B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

### C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).

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- 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
  - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
  - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
  - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
  3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
  4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

### D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

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- a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

23 34 13.13	Mixed Flow Laboratory Exhaust Fans
23 34 16	Centrifugal Fans
23 34 23	Power Ventilators
23 34 23	Prefabricated Curbs
23 35 14	Dust Collection Systems
23 36 00	Terminal Air Boxes
23 37 00	Grilles, Registers, and Diffusers
23 37 00	Louvers
23 40 00	Filters and Filter Systems
23 51 00	Prefabricated Stacks
23 52 00	Steam Generators
23 52 16	Condensing Boilers
23 52 23	Cast Iron Boilers
23 52 33.13	Finned Water Tube Boilers
23 52 33.14	High Efficiency Non-condensing Finned Water Tube Boilers
23 52 33.16	Steel Water Tube Boilers
23 52 39	Fire Tube Boilers
23 54 00	Furnaces
23 57 00	Heat Exchangers
23 57 33	Geothermal Heat Exchanger
23 61 16	Refrigerant Compressors
23 62 13	Condensing Units
23 62 13	Air Cooled Condensing Units
23 63 13	Condensers

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23 64 13	Absorption Water Chillers
23 64 16	Electric Water Chillers
23 64 17	Process Water Chillers
23 64 19	Reciprocating Water Chillers
23 64 30	Air Cooled Water Chillers
23 64 33	Modular Water Chillers
23 65 13.13	Induced Draft Cooling Tower
23 65 13.14	Blow-Through Cooling Tower
23 65 33	Evaporative Closed Circuit Cooling Tower
23 72 00	Energy Recovery Devices
23 73 13	Indoor Modular Air Handling Units
23 73 23	Custom Air Handling Units
23 74 13	Rooftop Modular Air Handling Units
23 74 16.12	Packaged Rooftop Air Conditioning Units - 25T and Below
23 74 16.13	Packaged Rooftop Air Conditioning Units - Above 25T
23 74 16.14	Packaged Rooftop Air Conditioning Units - High OA
23 74 23.13	Gas Fired Make-Up Air Units
23 75 13	Packaged Water Source Dedicated Outside AHU
23 81 13	Packaged Terminal Air Conditioning Units
23 81 21	Computer Room Units
23 81 26	Split System Air Conditioning Units
23 81 45	Variable Refrigerant Flow Heat Pumps
23 81 46	Packaged Water Source Heat Pumps
23 82 00	Terminal Heat Transfer Equipment
23 82 16	Coils
23 83 00	Radiant Floor Heating Systems
23 84 19	Pool Dehumidification Units

**1.7 SCHEDULE OF VALUES**

- A. The requirements herein are in addition to the provisions of Division 01.
- B. Format:
  - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
  - 2. Submit in Excel format.
  - 3. Support values given with substantiating data.
- C. Preparation:
  - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.

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2. Break down all costs into:
  - a. Material: Delivered cost of product with taxes paid.
  - b. Labor: Labor cost, excluding overhead and profit.
3. Itemize the cost for each of the following:
  - a. Overhead and profit.
  - b. Bonds.
  - c. Insurance.
  - d. General Requirements: Itemize all requirements.
4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
  - a. Each piece of equipment requiring shop drawings (e.g., each air handling unit, pump, exhaust fan, etc.). Use the equipment nomenclature (AHU-1, P-1, EF-1, etc.) on the Schedule of Values.
  - b. Each type of small unitary equipment (e.g., FCUs, UHs, CABs, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
  - c. Each piping system (chilled water, heating water, steam, condensate, etc.). In addition, for larger projects, break down the material and labor for each piping system based on geography (building, floor, and/or wing).
  - d. Each duct system (supply, return, relief, outside air, etc.) listed separately for each unit they serve (AHU-1 supply air ductwork, AHU-1 return air ductwork, etc.).
  - e. Pipe insulation with separate material and labor line items for each piping system listed above.
  - f. Duct insulation with separate material and labor line items for each duct system listed above.
  - g. Temperature controls broken down into material and labor for the following:
    - 1) Engineering
    - 2) Controllers, devices, sensors, etc.
    - 3) Control valves
    - 4) Control dampers
    - 5) Conduit
    - 6) Wiring

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- 7) Programming
  - 8) Commissioning
  - h. Site utilities (5' beyond building)
  - i. Seismic design
  - j. Air balancing
  - k. Water balancing
  - l. Commissioning
  - m. Record drawings
  - n. Punchlist and closeout
- D. Update Schedule of Values when:
- 1. Indicated by Architect/Engineer.
  - 2. Change of subcontractor or supplier occurs.
  - 3. Change of product or equipment occurs.

### 1.8 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

### 1.9 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:
  - 1. Air Cooled Condensers
  - 2. Condensing Units
  - 3. Gas Fired Makeup Air Units
  - 4. Fire Seal Systems
  - 5. Seismic Restraints and Equipment Bracing



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- B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.
- C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

### 1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.
- B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

### 1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

### 1.12 WARRANTY

- A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

### 1.13 INSURANCE

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- A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

### 1.14 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.
- D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.
- E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.
- F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

### 1.15 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and 23 08 00 and provide all services as described in the Commissioning Plan.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

**3.2 EXCAVATION, FILL, BACKFILL, COMPACTION**

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (<https://call811.com/>) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

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1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope around utilities to 6" above utilities: Place and compact sand or to a height of 6" over utilities in 6" layers. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill from 6" above utilities to earthen grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
4. Backfill from 6" above utilities to below slabs or paved area: Where the fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Backfill material shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Water shall not be permitted to rise in unbackfilled trenches.
6. Dispose of excess excavated earth as directed.
7. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
8. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

### F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

### 3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:
  1. Placing fill over underground and underslab utilities.

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2. Covering exterior walls, interior partitions and chases.
  3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation
1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
    - a. Pipe insulation is installed and fully sealed.
    - b. Pipe and duct wall penetrations are sealed.
    - c. Pipe identification and valve tags are installed.
    - d. Main, branch and flexible ducts are installed.
    - e. Diffusers, registers and grilles are installed and connected to ductwork.
    - f. Terminal air box reheat coil piping or wiring is complete.
    - g. Terminal air box control wiring is complete and all control boxes are closed.
  2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
  3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

### 3.4 INSTRUCTING THE OWNER'S REPRESENTATIVES

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.
- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The instructions shall include:

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1. Explanation of all system flow diagrams.
  2. Explanation of all air handling systems.
  3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
  4. Maintenance of equipment.
  5. Start-up procedures for all major equipment.
  6. Explanation of seasonal system changes.
  7. Description of emergency system operation.
- F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.
- G. Minimum hours of instruction for each item shall be:
1. Heat Pump System - insert hours.
  2. Exhaust System(s) - insert hours.
  3. Temperature Controls - As defined in Section 230900.
- H. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.
- I. Operating Instructions:
1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
  2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### 3.5 SYSTEM STARTING AND ADJUSTING

- A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.
- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place,

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acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

- C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.
- D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.
- E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.
- F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### 3.6 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 01 requirements.
- B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Refer to Section 230900 for additional requirements for Temperature Control documents.
- E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.
- F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.
- G. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

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- H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

### 3.7 PAINTING

- A. This Contractor shall paint the following items:
  - 1. All piping in mechanical room
  - 2. Piping exposed in kitchen
- B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
- C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.
- D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.
- E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.
- F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.
- G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.
- H. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.
- I. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:
  - 1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
  - 2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
  - 3. Color of paint shall be as follows:
    - a. All piping in mechanical room:
      - 1) Chilled Water: Blue pipe/black letters
      - 2) Condenser Water: Green pipe/black letters

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- 3) Heating Water: Orange pipe/black letters
- 4) Natural Gas: Yellow pipe/black letters
- b. Piping exposed in kitchen:
  - 1) All Piping: White

### 3.8 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.
- B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.
- C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.
- D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### 3.9 SPECIAL REQUIREMENTS

- A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.
- B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

### 3.10 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

- A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:
  1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
    - a. Minimizing the amount of dust generated.
    - b. Reducing solvent fumes and VOC emissions.
    - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
    - d. Protect stored on-site and installed absorptive materials from moisture damage.

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2. Request that the Owner designate an IAQ representative.
3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".
10. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.
11. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.
12. Construction areas shall be maintained at a negative pressure at all times during construction. When areas are under construction, HEPA filtered exhaust fan(s) shall be installed in sufficient quantities as required to maintain construction areas at sufficient negative pressure as called for in the Owner's Infection Control Risk Assessment (ICRA). HEPA filtered exhaust fan discharge shall be ducted either outdoors or back into designated hospital areas as called for in the Owner's ICRA.
13. For each area under construction, the Contractor shall install a negative pressure indicator equivalent to Lamiflow Model L-102F as manufactured by Lamiflow Technologies. Contractor shall regularly monitor and record the negative pressure condition of the construction areas as called for in the Owner's ICRA.

### 3.11 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

- A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.

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- B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.
- C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.
- D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.
- E. The following steps shall be taken during testing, adjusting, and balancing of each air system:
  - 1. All construction activities in all spaces served by the air system shall stop.
  - 2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
  - 3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
  - 4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.
- F. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

### 3.12 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

### 3.13 READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

- A. To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.
  - 1. Penetrations fire sealed and labeled in accordance with specifications.
  - 2. All air handling units operating and balanced.
  - 3. All fans shall be operating and balanced.
  - 4. All pumps, boilers and chillers operating and balanced.

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5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION 23 0500**

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**SECTION 23 0503  
THROUGH PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2018 International Building Code
- J. NFPA 5000 - Building Construction Safety Code

**1.2 DELIVERY, STORAGE, AND HANDLING**

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

**1.3 PERFORMANCE REQUIREMENTS**

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  - 1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  - 2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

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- C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

**1.4 MEETINGS**

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

**1.5 WARRANTY**

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

**PART 2 - PRODUCTS**

**TTHROUGH PENETRATIONS:**

*Alternate method of firestopping is patching opening to match original rated construction.
*Alternate method of firestopping is patching opening to match original rated construction.
*Alternate method of firestopping is patching opening to match original rated construction.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

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### 3.2 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.3 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### 3.4 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION 23 0503**

**Through Penetration Firestopping - 23 0503**

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**SECTION 23 0513  
MOTORS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Single Phase and Three Phase Electric Motors.

**1.2 REFERENCES**

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/NFPA 70 - National Electrical Code.
- G. Energy Independence and Security Act of 2007.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

**1.4 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

**PART 2 - PRODUCTS**

**2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS**

- A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460



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- B. Design motors for continuous operation in 40°C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.
- D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.
- F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.
- G. Each contractor shall set all motors furnished by him.
- H. All motors shall have a minimum service factor of 1.15.
- I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.
- J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.
- K. Aluminum end housings are not permitted on motors 15 HP or larger.
- L. Motor Driven Equipment:
  - 1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
  - 2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.
- M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.
- N. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

### 2.2 ELECTRICALLY COMMUTATED MOTORS (ECM)

**Motors - 23 0513**

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- A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.
- B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.
- C. All EC motors shall be a minimum of 85% efficient at all speeds.
- D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.
- E. Provide motor with on-board motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.
- F. Operational mode shall be as scheduled and shall be one of the following:
  - 1. Constant Flow
  - 2. Constant Temperature
  - 3. Constant Pressure

HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0
25.0	93.0	93.6	91.7	93.0	93.6	91.7
30.0	93.6	94.1	91.7	93.0	93.6	91.7
40.0	94.1	94.1	92.4	94.1	94.1	92.4
50.0	94.1	94.5	93.0	94.1	94.5	93.0
60.0	94.5	95.0	93.6	94.5	95.0	93.6
75.0	94.5	95.0	93.6	94.5	95.4	93.6
100.0	95.0	95.4	93.6	95.0	95.4	94.1
125.0	95.0	95.4	94.1	95.0	95.4	95.0
150.0	95.4	95.8	94.1	95.8	95.8	95.0
200.0	95.4	95.8	95.0	95.8	96.2	95.4
250.0	95.4	95.8	95.0	95.8	96.2	95.8

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300.0	95.4	95.8	95.4	95.8	96.2	95.8
350.0	95.4	95.8	95.4	95.8	96.2	95.8
400.0	95.8	95.8	95.8	95.8	96.2	95.8
450.0	96.2	96.2	95.8	95.8	96.2	95.8
500.0	96.2	96.2	95.8	95.8	96.2	95.8

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.
- B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.
- C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

**END OF SECTION 23 0513**

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**SECTION 23 0529  
HVAC SUPPORTS AND ANCHORS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Hangers, Supports, and Associated Anchors.
- B. Equipment Bases and Supports.
- C. Sleeves and Seals.
- D. Flashing and Sealing of Equipment and Pipe Stacks.
- E. Cutting of Openings.
- F. Escutcheon Plates and Trim.

**1.2 REFERENCES**

- A. ANSI/ASME B31.1 - Power Piping.
- B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- C. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
- D. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- E. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

**1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS**

- A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

**PART 2 - PRODUCTS**

**2.1 SEISMIC RESTRAINTS**

- A. Refer to Section 230550 for additional requirements for seismic restraints.

**2.2 HANGER RODS**

- A. Hanger rods for single rod hangers shall conform to the following:

Column #1: Steel pipe.
Column #2: Copper, plastic and fiberglass reinforced pipe.

- B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.
- C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

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D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

1. This applies to the following areas: [Insert].

### 2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.
  - a. Products:
    - 1) Cooper/B-Line Fig B3373 Series
    - 2) Erico 510 Series
    - 3) Nibco/Tolco Fig. 82
  2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.
    - a. Products:
      - 1) Mason RBA, RCA or RDA
      - 2) Mason BR
    3. Cold Pipe Alternative: Insulated pipe riser clamp with no thermal bridging between clamp and pipe; water repellent calcium silicate insulation material adhered inside the clamp; ASTM A653 galvanized steel clamp.
      - a. Products:
        - 1) Pipeshields E100
    4. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical

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length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

### C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

#### a. Products:

- 1) Anvil Fig. 160, 161, 162, 163, 164, 165
- 2) Cooper/B-Line Fig. 3160, 3161, 3162, 3163, 3164, 3165
- 3) Erico Model 630, 631, 632, 633, 634, 635
- 4) Nibco/Tolco Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. Unless otherwise indicated, hangers shall be as follows:

#### a. Clevis Type: Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and Smaller:

##### 1) Products: Bare Steel, Plastic or Insulated Pipe:

- (a) Anvil Fig. 260
- (b) Cooper/B-Line Fig. 3100
- (c) Erico Model 400
- (d) Nibco/Tolco Fig. 1

##### 2) Products: Bare Copper Pipe:

- (a) Cooper/B-Line Fig. B3100C
- (b) Nibco/Tolco Fig. 81PVC

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- b. Roller Type: Service: Insulated Hot Pipe - 4 inches and Larger:
  - 1) Products: 4" through 6":
    - (a) Anvil Fig. 181, 271
    - (b) Cooper/B-Line Fig. 3110, 3117
    - (c) Erico Model 610
    - (d) Nibco/Tolco Fig. 324, 327
  - 2) Products: 8" and Above:
    - (a) Anvil Fig. 171, 271
    - (b) Cooper/B-Line Fig. 3114, 3117
    - (c) Erico Model 605
    - (d) Nibco/Tolco Fig. 322, 327
- c. Continuous Channel with Clevis Type: Service: Plastic Tubing, Flexible Hose, Soft Copper Tubing:
  - 1) Products:
    - (a) Cooper/B-Line Fig. B3106, with Fig. B3106V
    - (b) Erico Model 104, with Model 104V
    - (c) Nibco/Tolco Fig. 1V
- d. Adjustable Swivel Ring Type: Service: Bare Metal Pipe - 4 inches and Smaller:
  - 1) Products: Bare Steel Pipe:
    - (a) Anvil Fig. 69
    - (b) Cooper/B-Line Fig. B3170NF
    - (c) Erico Model FCN
    - (d) Nibco/Tolco Fig. 200.
  - 2) Products: Bare Copper Pipe:
    - (a) Cooper/B-Line Fig. B3170CTC
    - (b) Erico 102A0 Series
    - (c) Nibco/Tolco Fig. 203

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6. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
  - a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
  - b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
7. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
  - a. Clamp Type: Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller:
    - 1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, Erico Cushion Clamp or Cooper Vibra-Clamp.
    - 2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
    - 3) Products: Bare Steel, Plastic or Insulated Pipe:
      - (a) Unistrut Fig. P1100 or P2500
      - (b) Cooper/B-Line Fig. B2000 or B2400
      - (c) Nibco/Tolco Fig. A-14 or 2STR
    - 4) Products: Bare Copper Pipe:
      - (a) Cooper/B-Line Fig. BVT
  - b. Roller Type: Service: Insulated Hot Pipe - 4 inches and larger:
    - 1) Products: 4" through 6":
      - (a) Unistrut Fig. P2474
      - (b) Cooper/B-Line Fig. B218
      - (c) Nibco/Tolco Fig. ROL-12
    - 2) Products: 8" and Above:
      - (a) Unistrut Fig. P2474-1
      - (b) Cooper/B-Line Fig. B219
      - (c) Nibco/Tolco Fig. ROL-13



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### D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:
  - a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):
    - 1) Products:
      - (a) Anvil Fig. 92
      - (b) Cooper/B-Line Fig. B3033/B3034
      - (c) Erico Model 300
      - (d) Nibco/Tolco 68
  - b. Scissor Type Beam Clamps (for use with bar-joists and wide flange):
    - 1) Products:
      - (a) Anvil Fig. 228, 292
      - (b) Cooper/B-Line Fig. B3054
      - (c) Erico Model 360
      - (d) Nibco/Tolco Fig. 329
  - c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):
    - 1) Products:
      - (a) MCL. M1, M2 or M3
  - d. Concrete: Inserts Single Rod Galvanized:
    - 1) Products:
      - (a) Anvil Fig. 282
      - (b) Cooper/B-Line Fig. B3014
      - (c) Erico Model 355
      - (d) Nibco/Tolco Fig. 310
  - e. Concrete: Inserts Continuous Strip Galvanized:
    - 1) Products:
      - (a) Unistrut Corp P3200 Series
      - (b) Cooper/B-Line Fig. B22-J

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- (c) Erico CONCT
- f. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-[05]. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
- g. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.
- h. Steel Structure Welding:
  - 1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.
- i. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.
  - 1) Minimum allowable tension loads for Douglass Fir/Southern Pine:
    - (a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
    - (b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".
  - 2) Limitations:
    - (a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer<sup>TMTM</sup>s approval.
    - (b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
    - (c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
    - (d) Spacing: Refer to wood structure spacing of hangers.
  - 3) Products:
    - (a) Simpson RWV
    - (b) DeWALT
    - (c) ITI Sammys GT25

### 2.4 FOUNDATIONS, BASES, AND SUPPORTS

#### A. Basic Requirements:

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1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
  2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.
- B. Concrete Bases (Housekeeping Pads):
1. Refer to Section 23 0550 for additional requirements for concrete bases in seismic applications.
  2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).
  3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
  4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days (be 20 MPa strength).
  5. Equipment requiring bases is as follows:
    - a. Air Compressor
    - b. Air Handling Unit
    - c. Expansion Tank
    - d. Fans
    - e. Furnace
    - f. Pump
    - g. Tank
- C. Supports:
1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
  2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.
- D. Grout:
1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.

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2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

### 2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

- A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.
- B. Coordinate all openings with other Contractors.
- C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.
- D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.
- E. Do not cut structural members without written approval of the Architect or Structural Engineer.
- F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

### 2.6 ROOF PENETRATIONS

- A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe and duct penetrations. Refer to drawings for details.
- B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: White shall match roofing material.
- C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

### 2.7 SLEEVES AND LINTELS

- A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.
- B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.
- C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
- D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas.

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- E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.
- F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
- G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
- H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
- I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.
- J. Wall Seals ("Link-Seals"):
  - 1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
  - 2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
  - 3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
  - 4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
  - 5. Sealing element shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

- K. Manufacturers:
  - 1. Thunderline Corporation "Link-Seals"
  - 2. O-Z/Gedney Company
  - 3. Calpico, Inc.

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4. Innerlynx
5. Metraflex Company (cold service only)

### 2.8 ESCUTCHEON PLATES AND TRIM

- A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.
- B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.
- C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

### 2.9 PIPE PENETRATIONS

- A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.
- B. Seal fire rated wall and floor penetrations with fire seal system as specified.

### 2.10 PIPE ANCHORS

- A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
- B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

### 2.11 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

## PART 3 - EXECUTION

### 3.1 HVAC SUPPORTS AND ANCHORS

- A. General Installation Requirements:
  1. Install all items per manufacturer's instructions.
  2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
  3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
  4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.
- B. Supports Requirements:

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1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

### C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

### D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
  - a. The hanger is attached within 6" from a web/chord joint.
  - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

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3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.
- E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.
- H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
  1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" & under: 7'-0"
      - 2) 1-1/2": 9'-0"
      - 3) 2": 10'-0"
      - 4) 2-1/2": 11'-0"
      - 5) 3": 12'-0"
      - 6) 4" & larger: 12'-0"
  2. Steel (Std. Weight or Heavier - Vapor Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" and under: 9'-0"
      - 2) 1-1/2": 12'-0"
      - 3) 2" & larger: 12'-0"
  3. Hard Drawn Copper & Brass (Liquid Service):
    - a. Maximum Spacing:
      - 1) 3/4" and under: 5'-0"
      - 2) 1": 6'-0"



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- 3) 1-1/4": 7'-0"
  - 4) 1-1/2" 8'-0"
  - 5) 2": 8'-0"
  - 6) 2-1/2": 9'-0"
  - 7) 3": 10'-0"
  - 8) 4": 12'-0"
  - 9) 6": 12'-0"
4. Hard Drawn Copper & Brass (Vapor Service):
- a. Maximum Spacing:
    - 1) 3/4" & under: 7'-0"
    - 2) 1": 8'-0"
    - 3) 1-1/4": 9'-0"
    - 4) 1-1/2": 10'-0"
    - 5) 2": 11'-0"
    - 6) 2-1/2" & larger: 12'-0"
5. Plastic Pipe:
- a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.
6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:
- a. Continuous channel with hangers maximum 8'-0" OC.
- I. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:
1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):
    - a. Maximum Spacing:
      - 1) 1-1/4" & under: 7'-0"
      - 2) 1-1/2": 9'-0"
      - 3) 2": 10'-0"
      - 4) 2-1/2": 11'-0"

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- 5) 3": 12'-0"
  - 6) 4" & larger: 12'-0"
2. Steel (Std. Weight or Heavier - Vapor Service):
- a. Maximum Spacing:
    - 1) 1/2" and under: 6'-0"
    - 2) 3/4" to 1": 8'-0"
    - 3) 1-1/4" and under: 9'-0"
    - 4) 1-1/2": 10'-0"
    - 5) 2" & larger: 10'-0"
3. Hard Drawn Copper & Brass (Liquid Service):
- a. Maximum Spacing:
    - 1) 3/4" and under: 5'-0"
    - 2) 1": 6'-0"
    - 3) 1-1/4": 6'-0"
    - 4) 1-1/2" 6'-0"
    - 5) 2": 8'-0"
    - 6) 2-1/2": 9'-0"
    - 7) 3": 10'-0"
    - 8) 4": 10'-0"
    - 9) 6": 10'-0"
4. Hard Drawn Copper & Brass (Vapor Service):
- a. Maximum Spacing:
    - 1) 3/4" & under: 6'-0"
    - 2) 1": 6'-0"
    - 3) 1-1/4": 6'-0"
    - 4) 1-1/2": 6'-0"
    - 5) 2": 10'-0"

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6) 2-1/2" & larger: 10'-0"

5. Plastic Pipe:

a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

6. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:

a. Continuous channel with hangers maximum 8'-0" OC.

J. Installation of hangers shall conform to MSS SP-58, 69, and 89.

**END OF SECTION 23 0529**

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**SECTION 23 0548  
HVAC VIBRATION ISOLATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Bases.
- B. Vibration Isolation.
- C. Flexible Connectors.

**1.2 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500 and the Vibration Isolation Submittal Form at the end of this section.
- B. Vibration isolation submittals may be included with equipment being isolated, but must comply with this section.
- C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.
- D. Isolator submittals shall include:
  - 1. Equipment served
  - 2. Type of Isolator
  - 3. Load in Pounds per Isolator
  - 4. Recommended Maximum Load for Isolator
  - 5. Spring Constants of Isolators (for Spring Isolators)
  - 6. Load vs. Deflection Curves (for Neoprene Isolators)
  - 7. Specified Deflection
  - 8. Deflection to Solid (at least 150% of calculated deflection)
  - 9. Loaded (Operating) Deflection
  - 10. Free Height
  - 11. Loaded Height
  - 12. Kx/Ky (horizontal to vertical stiffness ratio - for spring isolators)
  - 13. Materials and Coatings
  - 14. Spring Diameters
- E. Make separate calculations for each isolator on equipment where the load is not equally distributed.

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- F. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.
- G. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 230550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- H. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.
- I. Seismic restraint calculations or HCAI pre-approved seismic restraint tables (ISAT or equal) HCAI series OPM pre-approval. Utilize ICBO approved seismic brackets for suspended utilities.
- J. Submit calculations by a licensed Structural Engineer substantiating that equipment mountings and foundations, and their seismic restraints, can meet the required external forces "G" load for all rigidly and resiliently supported equipment without failure and permanent displacement. Submit similar calculations for life safety equipment restraints for "G" loading. Restrain all resiliently mounted piping with cable seismic bracing per HCAI series OPM pre-approval.
- K. Contractor shall provide seismic bracing calculations stamped by a licensed Nevada Structural Engineer for all suspended utilities.
  - 1. Contractor to submit shop drawings showing the following:
    - a. All seismic bracing locations and type of restraint being used.
    - b. Maximum seismic loads shall be indicated on the shop drawings for each brace location.
    - c. Manufacturer's seismic restraint layout on contractor shop drawings to be stamped by a Structural Engineer licensed in the State of Nevada for all suspended utilities.

## **PART 2 - PRODUCTS**

### **2.1 BASIC CONSTRUCTION AND REQUIREMENT**

- A. Vibration isolation for this project is subject to seismic restraint requirements of Section 230550.

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- B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.
- C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.
- D. The lateral to vertical stiffness ratio ( $K_x/K_y$ ) of spring isolators shall be between 0.8 and 2.0.
- E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.
- F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.
- G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.
- H. Provide motor slide rails for belt-driven equipment per Section 230513.
- I. All isolators, except M1, shall have provision for leveling.
- J. Construction criteria and standards of seismic restraint design for suspended pipes, ducts and mechanical equipment shall be per the International Seismic Application Technology (ISAT) HCAI OPM #0485. (877)999-ISAT or Mason.

### 2.2 MOUNTINGS

- A. Type M1:
  - 1. 0.75" thick waffled neoprene pad with minimum static deflection of 0.07" at calculated load and 0.11" at maximum load. For loads less than 15 pounds, the deflection at calculated load requirement is waived, but the isolator must have a maximum stiffness of the ratio of 45#/0.35".
  - 2. Units need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators.
  - 3. Manufacturers:
    - a. Mason "Super W"
    - b. Kinetics "NGS"
    - c. Amber/Booth "SPNR"
    - d. Vibration Eliminator Co. "400N"

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### B. Type M2:

1. Double deflection neoprene with minimum static deflection of 0.15" at calculated load and 0.35" at maximum rated load.
  - a. All metal shall be neoprene covered. Mounting shall have friction pads both top and bottom.
2. All units shall have bolt holes and be bolted down.
3. Use steel rails above the mountings to compensate for the overhang of equipment such as small vent sets and close coupled pumps.
4. Manufacturers:
  - a. Mason Industries "ND" or "DNR"
  - b. Amber/Booth "RVD"
  - c. Kinetics "RD"
  - d. Vibration Mountings and Controls "RD"
  - e. Vibration Eliminator Co. "T22" or "T44"

### C. Type M3:

1. Free standing, laterally stable spring isolators without housings and complete with 1/4" neoprene friction pads.
2. Units shall have bolt holes but need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators. Bolt holes shall not be within the springs.
3. All mountings shall have leveling bolts.
4. Manufacturers:
  - a. Mason "SLFH"
  - b. Kinetics "FDS"
  - c. Amber/Booth SW-3 [4"][, 5"][, or][ 6"]
  - d. Vibration Eliminator Co. "OST"

### D. Type M4:

1. Use restrained spring mountings for equipment with operating weight different from the installed weight such as chillers and boilers, and equipment exposed to the wind such as cooling towers.
2. Spring isolators shall be free-standing with 1/4" neoprene acoustical friction pads.

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3. All units shall have bolt holes and be bolted down. Prevent short circuiting with neoprene bushings and washers between bolts and isolators.
4. All mountings shall have leveling bolts.
5. Housings with vertical resilient limit stops shall prevent spring extension when weight is removed. Housings shall serve as blocking during erection and the installed and operating heights shall be the same.
6. Maintain a minimum clearance of 1/2" around restraining bolts and between the housings and the springs so as not to interfere with the spring action.
7. Limit stops shall be out of contact during normal operation.
8. Select isolators for equipment subjected to wind loads in conformance with ASCE 7-02.
9. Manufacturers:
  - a. Mason "SLRS"
  - b. Kinetics "FLS"
  - c. Aeroflex "AWRS"
  - d. Vibration Eliminator Co. "KW"

### 2.3 HANGERS

#### A. Type H1:

1. Vibration hangers shall consist of a double-deflection neoprene element with a projecting bushing or oversized opening to prevent steel-to-steel contact.
2. Static deflection shall be at least 0.15" at calculated load and 0.35" at maximum rated load.
3. Provide hangers with end connections as required for hanging ductwork or piping.
4. Manufacturers:
  - a. Mason "HD"
  - b. Kinetics "RH"
  - c. Aeroflex "RHD"
  - d. Vibration Eliminator Co. "IC/3C/3CTD"
  - e. Vibro Acoustics "RH"

#### B. Type H2:

1. Vibration hangers shall contain a steel spring in a neoprene cup with a grommet to prevent short circuiting the hanger rod.



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2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Manufacturers:
  - a. Mason "30"
  - b. Kinetics "SRH"
  - c. Amber/Booth "BSRA"
  - d. Aeroflex "RSH"
  - e. Vibration Eliminator Co. "SNC"
  - f. Vibro Acoustics "SH/SHC"

### C. Type H3:

1. Vibration hangers shall have a steel spring in a neoprene cup with a grommet to prevent short circuiting of the hanger rod.
2. The cup shall have a steel washer to distribute load on the neoprene and prevent its extrusion.
3. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the grommet and short circuiting the spring.
4. Provide end connections for hanging ductwork or piping.
5. Hangers shall be capable of holding the load at a fixed elevation during installation. They shall have a secondary adjustment to transfer the load to the spring and maintain the same position.
6. Deflection shall be indicated by a pointer and scale.
7. Manufacturer:
  - a. Mason "30N"
  - b. Kinetics "SFH"
  - c. Amber/Booth "BSW"
  - d. Vibration Eliminator Co. "SNRC"
  - e. Vibro Acoustics "SHR"

## 2.4 FLEXIBLE CONNECTORS (NOISE AND VIBRATION ELIMINATORS)

### A. Type FC1:

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1. Spherical flexible connectors with multiple plies of nylon tire cord fabric and either EPDM or molded and cured neoprene. Outdoor units shall be EPDM.
  2. Steel aircraft cables or threaded steel rods shall be used to prevent excess elongation.
  3. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer.
  4. Connectors up to 2" size may have threaded ends.
  5. Connectors 2-1/2" and over shall have floating steel flanges recessed to lock raised face neoprene flanges.
  6. All connectors shall be rated for a minimum working pressure of 150 psi at 200°F.
  7. Manufacturer:
    - a. Metraflex "Double Cable-Sphere"
    - b. Minnesota Flex Corp.
    - c. Mercer "200 Series"
    - d. Twin City Hose "MS2".
- B. Type FC2:
1. Stainless steel flexible connectors with corrugated stainless steel hose body and stainless steel braided casing.
  2. Rated for minimum working pressures of 150 psi at 70°F and 100 psi at 800°F .
  3. Sizes 2" and under shall have steel threaded connections.
  4. Sizes 2-1/2" and over shall have 150 lb. steel flanges.
  5. Suitable for 1/2" permanent misalignment.
  6. Manufacturers:
    - a. Mason or Mercer "BSS-GU"
    - b. Metraflex "ML"
    - c. Twin City Hose "TCHS"
    - d. American "BOA B4-1"
    - e. Flexible Metal Hose Company "FM-21"
    - f. or Wheatley.

### **PART 3 - EXECUTION**

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### 3.1 GENERAL INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Provide vibration isolation as indicated on the drawings and as described herein.
- C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.
- D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.
- E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.
- F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as rectangular ducts or pipes supported on a strut rack.

### 3.2 PIPE ISOLATION

- A. The first three hangers from vibration-isolated equipment shall be type H1.
- B. Install flexible connectors in all piping connected to vibration producing equipment. This includes all fans, base-mounted pumps, compressors, etc. Absence of flexible connectors on piping diagrams does not imply that they are not required.
- C. Provide sufficient piping flexibility for vibrating refrigerant equipment, or furnish flexible connectors with appropriate temperature and pressure ratings.
- D. Support piping to prevent extension of flexible connectors.

### 3.3 VIBRATION ISOLATION OF DUCTWORK

- A. The first three hangers on all fan systems shall be Type H1 with at least 0.20" minimum static deflection.
- B. The first three hangers on all fan systems with static pressure greater than 1.0" shall be Type H2 with 0.75" minimum static deflection. All other hangers supporting ductwork within 50' of and connected to vibration-isolated equipment shall be Type H1 with at least 0.20".
- C. Provide flexible duct connections as described in Section 233300 at all fan inlets and outlets and on the mechanical room side of all locations where ducts penetrate mechanical room walls.

### 3.4 VIBRATION ISOLATION SCHEDULE

- A. Inline Pumps:
  - 1. Base Type: NA

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2. Isolator Type: M3 or H2 or H3
  3. Static Deflection :[0.75"][1.5"]
  4. Flexible Connections: NA
- B. AHU Fans:
1. Base Type: B1 or B2 or B3
  2. Isolator Type: M3 and/or TR1
  3. Static Deflection: Refer to ASHRAE Table
  4. Flexible Connections: Per Section 233300

**END OF SECTION 23 0548**

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**SECTION 23 0550  
SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

A. Seismic Requirements.

**1.2 QUALITY ASSURANCE**

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 23 0529 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

D. Installer: Company specializing in performing the work of this Section.

**1.3 REFERENCES**

- A. International Building Code, 2018.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. Technical Manual 5-809-10, NAVFAC P-355, Air Force Manual 88-3, Chapter 13.
- D. ASCE 7-02, Chapter 9.
- E. ASCE 7-05, Chapter 13. ASCE 7-10, Chapter 13. ASCE 7-16, Chapter 13.
- F. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.

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- G. NFPA 13 - Installation of Sprinkler Systems.
- H. NFPA 14 - Standpipe and Hose Systems.

### 1.4 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the International Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.
- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

### 1.6 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, 2018 edition.
- B. The following criteria are applicable to this project:
  - 1. Risk Category: IV
  - 2. Seismic Importance Factor:  $IE = 1.5$  Seismic Design Category: D
  - 3. Component Amplification Factors ( $a_p$ ) and Component Response Modification Factors ( $R_p$ ) shall be taken from Table 13.5-1 in ASCE 7-16 for the individual equipment or system being restrained.
  - 4. Component Importance Factors ( $I_p$ ) shall be taken from Section 13.1.3 in ASCE 7-16 for the individual equipment or system being restrained.
  - 5. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. Forces shall be calculated with the above requirements and Equation 13.3-1, -2, and -3 of ASCE 7-16, unless exempted by 13.1.4. Equipment shall meet International Building Code and ASCE 7 seismic

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qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

### 1.7 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

### 1.8 WARRANTY

- A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of piping, ductwork, conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment, piping, or ductwork, resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.

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- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit.
- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical pipe risers flexibly supported to accommodate thermal motion and/or pipe vibration shall be guided to maintain pipe stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.
- U. Water tanks shall be secured to their saddles by welding or proper concrete attachment, and those saddles shall be properly attached to the structure.
- V. Brace all terminal units with water coils as required by the building code and provide flexible connection to the coil if bracing is required.
- W. Independently brace duct mounted equipment (terminal units, in-line fans, etc.) and the associated suspended ductwork.
- X. Do not brace a system to two different structures such as a wall and a ceiling.
- Y. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- Z. Positively attach all roof mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- AA. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.
- BB. Coordinate seismic bracing of architecturally exposed ductwork with the Architect/Engineer.

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**3.2 SEISMIC RESTRAINT EXCLUSIONS**

A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

**END OF SECTION 23 0550**

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**SECTION 23 0553  
HVAC IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Identification of products installed under Division 23.

**1.2 REFERENCES**

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. ASTM B1, B3, and B8 for copper conductors.
- C. ASTM D-248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 - 2kV Cables.
- D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
- E. NFPA-99 - Health Care Facilities.
- F. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. 3M
- B. Bunting
- C. Calpico
- D. Craftmark
- E. Emedco
- F. Kolbi Industries
- G. Seton
- H. W.H. Brady
- I. Marking Services.

**2.2 MATERIALS**

- A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

Plastic tags may be used for outside diameters under 3/4" (20 mm)

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- B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
- C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
- D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
- E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
- F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
- G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.
- H. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.
- I. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.
- J. Tracer Wire:
  - 1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
  - 2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
  - 3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.
- K. Ductwork Markers:
  - 1. Ductwork systems containing hazardous materials shall be provided with minimum 2" x 4" ANSI Z535.2 biohazard warning labels with custom labeling describing hazard. Refer to Part 3 for system and label description.
  - 2. Vinyl Markers: Colored vinyl with permanent pressure sensitive adhesive backing suitable for indoor and outdoor application.
- L. Maintenance Access Doors:
  - 1. Doors and roof hatches used to access equipment serving hazardous ductwork systems shall be provided with a minimum 4" x 6" ANSI Z535.2 biohazard warning label. Label shall read "WARNING - BIOHAZARD. ONLY AUTHORIZED PERSONNEL BEYOND THIS POINT".

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2. Coordinate location of warning label with Owner.

### M. Ceiling Markers:

#### 1. Label Style:

- a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves. An arrow can be used to point to the tile needing removal.
- b. The label tape shall be approximately 1/2" wide with all capitalized letters approximately 3/16" tall.
- c. Ceiling grid labels shall be made with a label maker with durable adhesive labels having a clear background and black letters.
- d. Equipment labels shall be as designated on the drawings (e.g., FCU-606B, etc.).
- e. Valve labels shall be designated by the size, service, and the valve tag number (e.g., 1-1/4" CW #123, 2" HWS #234, etc.). A single longer label can be used to identify multiple valves using spaces between the descriptors if the valves are located close together and have the same service (e.g., HWS and HWR valves serving the same equipment or CW, HW, and HWC lines serving the same restroom, etc.).
- f. Fire, fire/smoke and smoke dampers shall be labeled consistent with the type (e.g., Fire Damper, Fire/Smoke Damper, etc.).

#### 2. "Dot" Style:

- a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves.
- b. The marker shall be a self-adhesive color dot approximately 1/2" in diameter.
- c. The equipment and accessories to be marked and dot color shall be coordinated with the Architect/Engineer and Owner.
- d. Equipment and accessories to be marked:
  - 1) Hydronic Valves
  - 2) Fire Dampers
  - 3) Fire/Smoke and Smoke Dampers
  - 4) Fan Coil Units
  - 5) Project Specific Item

## PART 3 - EXECUTION

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### 3.1 INSTALLATION

- A. Install all products per manufacturer's recommendations.
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Pipe Markers:
  - 1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
  - 2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
  - 3. Stencil Painted Pipe Markers:
    - a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
    - b. Apply primer on non-insulated pipes before painting.
    - c. Use background and letter colors as scheduled later in this section.
  - 4. Apply markers and arrows in the following locations where clearly visible:
    - a. At each valve.
    - b. On both sides of walls that pipes penetrate.
    - c. At least every 20 feet along all pipes.
    - d. On each riser and each leg of each "T" joint.
    - e. At least once in every room and each story traversed.
  - 5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.
- D. Ductwork Markers:
  - 1. Apply ductwork markers on ductwork systems containing hazardous materials in the following locations where clearly visible:
    - a. On both sides of walls that ducts penetrate.
    - b. At least every 20 feet along all ducts.
    - c. On each riser and each leg of each branch connection.
    - d. At least once in every room and each story traversed.
    - e. At all ductwork access doors.

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- f. At all fans and equipment serving ductwork system. Markers shall be clearly visible from the normal maintenance access path to the equipment. Coordinate placement location with Owner.

### E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

### F. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.
2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

## 3.2 SCHEDULE

### A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. CONDENSATE DRAIN: White lettering; green background
2. COMPRESSED AIR: White lettering; green background
3. NATURAL GAS: Black lettering; yellow background
4. REFRIGERANT LIQUID: White lettering; purple background
5. REFRIGERANT SUCTION: White lettering; purple background
6. REFRIGERANT HOT GAS: White lettering; purple background

### B. Ductwork and Fan Systems: All fans, filters housings, and access doors shall be labeled with text as follows:

1. WARNING - CHEMICAL FUME EXHAUST: Black lettering; orange/white background
2. warning - ISOLATION ROOM EXHAUST: Black lettering; orange/white background

**END OF SECTION 23 0553**

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**SECTION 23 0593  
TESTING, ADJUSTING AND BALANCING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Testing, adjusting, and balancing of air systems.
- B. Testing, adjusting, and balancing of plumbing systems.
- C. Measurement of final operating condition of HVAC systems.

**1.2 QUALITY ASSURANCE**

- A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.
- B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

**1.3 REFERENCES**

- A. AABC - National Standards for Total System Balance, Seventh Edition.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.
- D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.
- E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.
- F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.
- G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing, Third Edition, 2002.
- H. TABB - International Standards for Environmental Systems Balance.

**1.4 SUBMITTALS**

- A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.
- B. Electronic Copies:
  - 1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any

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permission restrictions on files; protected, locked, or secured documents will be rejected.

2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

### C. Paper Copies:

1. Submit four (4) certified copies of test reports to the Architect/Engineer for approval in soft cover, 3-hole binder manuals, with cover identification. Include index page and indexing tabs.

## 1.5 REPORT FORMS

- A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.
- B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.
- C. Refer to PART 4 for required reports.

## 1.6 WARRANTY/GUARANTEE

- A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.
- B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

## 1.7 SCHEDULING

- A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.
- B. Project will be constructed in phases. Provide balancing report after each phase is complete.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 GENERAL REQUIREMENTS

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- A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.
- B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.
- C. Recorded data shall represent actual measured or observed conditions.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.
- E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.
- G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 230900 for additional information.
- H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

### 3.2 EXAMINATION

- A. Before beginning work, verify that systems are complete and operable. Ensure the following:
  - 1. General Equipment Requirements:
    - a. Equipment is safe to operate and in normal condition.
    - b. Equipment with moving parts is properly lubricated.
    - c. Temperature control systems are complete and operable.
    - d. Proper thermal overload protection is in place for electrical equipment.
    - e. Direction of rotation of all fans and pumps is correct.
    - f. Access doors are closed and end caps are in place.
  - 2. Duct System Requirements:
    - a. All filters are clean and in place. If required, install temporary media.
    - b. Duct systems are clean and free of debris.
    - c. Fire/smoke and manual volume dampers are in place, functional and open.

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- d. Air outlets are installed and connected.
  - e. Duct system leakage has been minimized.
3. Pipe System Requirements:
- a. Coil fins have been cleaned and combed.
  - b. Hydronic systems have been cleaned, filled, and vented.
  - c. Strainer screens are clean and in place.
  - d. Shutoff, throttling and balancing valves are open.
- B. Report any defects or deficiencies to Architect/Engineer.
- C. Promptly report items that are abnormal or prevent proper balancing.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

### 3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.
- B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

### 3.4 INSTALLATION TOLERANCES

- A.  $\pm 10\%$  of scheduled values:
  - 1. Adjust air inlets and outlets to  $\pm 10\%$  of scheduled values.
  - 2. Adjust piping systems to  $\pm 10\%$  of design values.
- B.  $\pm 5\%$  of scheduled values:
  - 1. Adjust fume exhaust systems to  $\pm 5\%$  of scheduled values.
  - 2. Adjust supply and exhaust air-handling systems for space pressurization to  $\pm 5\%$  of scheduled values, and to provide proper pressurization.
- C.  $+ 5\%$  of scheduled values
  - 1. Adjust outdoor air intakes to within  $+ 5\%$  of scheduled values.
  - 2. Adjust exhaust air through energy recovery equipment to within  $+5\%$  of scheduled values.
- D. Adjust supply, return, and exhaust air-handling systems to  $+10\%$  /  $-5\%$  of scheduled values.

### 3.5 ADJUSTING

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- A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.
- B. Once balancing of systems is complete, at least one damper or valve must be 100% open.
- C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.
- D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.
- E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

### 3.6 SYSTEM PERFORMANCE REPORT

- A. After the conclusion of balancing operations, utilize the building DDC system or install portable data loggers to simultaneously record temperatures and humidity during summer and winter conditions for a seven-day period, continuous over a weekend, and including at least one period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition and within 10°F dry bulb temperature of minimum winter design condition.
- B. Design Conditions:
  - 1. Summer: \_\_\_ °F DB \_\_\_ °F WB
  - 2. Winter: \_\_\_ °F DB
- C. Architect/Engineer will direct all test locations.
- D. Report of test results shall include original recording and three reproductions.

### 3.7 SUBMISSION OF REPORTS

- A. Fill in test results on appropriate forms.

### 3.8 PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

### 3.9 GENERAL REQUIREMENTS

- A. Title Page:
  - 1. Project name.
  - 2. Project location.
  - 3. Project Architect.
  - 4. Project Engineer (IMEG Corp.).
  - 5. Project General Contractor.
  - 6. TAB Company name, address, phone number.

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7. TAB Supervisor's name and certification number.
  8. TAB Supervisor's signature and date.
  9. Report date.
- B. Report Index
- C. General Information:
1. Test conditions.
  2. Nomenclature used throughout report.
  3. Notable system characteristics/discrepancies from design.
  4. Test standards followed.
  5. Any deficiencies noted.
  6. Quality assurance statement.
- D. Instrument List:
1. Instrument.
  2. Manufacturer, model, and serial number.
  3. Range.
  4. Calibration date.

### 3.10 AIR SYSTEMS

- A. Duct Leakage Test:
1. Air system and fan.
  2. Leakage class.
  3. Test pressure.
  4. Construction pressure.
  5. Flow rate (cfm): specified and actual.
  6. Leakage (refer to Section 233100 in the specifications): specified and actual.
  7. Statement that fire dampers, reheat coils and other accessories were included in the test.
  8. Pass or Fail.
  9. Test performed by.

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10. Test witnessed by.
- B. Air Moving Equipment:
1. General Requirements:
    - a. Drawing symbol.
    - b. Location.
    - c. Manufacturer, model, arrangement, class, discharge.
    - d. Fan RPM.
    - e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
    - f. Final frequency of motor at maximum flow rate (on fans driven by VFD).
  2. Flow Rate:
    - a. Supply flow rate (cfm): specified and actual.
    - b. Return flow rate (cfm): specified and actual.
    - c. Outside flow rate (cfm): specified and actual.
    - d. Exhaust flow rate (cfm): specified and actual.
  3. Pressure Drop and Pressure:
    - a. Filter pressure drop: specified and actual.
    - b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
    - c. Inlet pressure.
    - d. Discharge pressure.
- C. Fan Data:
1. Drawing symbol.
  2. Location.
  3. Manufacturer and model.
  4. Flow rate (cfm): specified and actual.
  5. Total static pressure: specified and actual. (Indicate measurement locations).
  6. Inlet pressure.
  7. Discharge pressure.

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8. Fan RPM.
- D. Electric Motors:
1. Drawing symbol of equipment served.
  2. Manufacturer, Model, Frame.
  3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
  4. Measured: Amps in each phase.
- E. Duct Traverse:
1. System zone/branch/location.
  2. Duct size.
  3. Free area.
  4. Velocity: specified and actual.
  5. Flow rate (cfm): specified and actual.
  6. Duct static pressure.
  7. Air temperature.
  8. Air correction factor.
- F. Air Terminal (Inlet or Outlet):
1. Drawing symbol.
  2. Room number/location.
  3. Terminal type and size.
  4. Velocity: specified and actual.
  5. Flow rate (cfm): specified and actual.
  6. Percent of design flow rate.
- G. Fume Hood:
1. Drawing symbol.
  2. Location.
  3. Manufacturer and Model.
  4. Total flow rate (cfm): specified and actual.

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5. Test velocities.
  6. Hood opening dimensions.
- H. Positive Air Flow Test:
1. Occupied Supply Air (Max./Min.) Flow rate (cfm): specified and actual.
  2. Occupied Return Air (Max./Min.) Flow rate (cfm): specified and actual.
  3. Unoccupied Supply Air (Max./Min.) Flow rate (cfm): specified and actual.
  4. Unoccupied Return Air (Min./Max.) Flow rate (cfm): specified and actual.
- I. Fire, Smoke, and Fire/Smoke Dampers:
1. Damper ID #.
  2. System identification.
  3. Type.
  4. Size.
  5. UL assembly number.
  6. Location of damper and access door.
  7. Fusible link temperature rating.
  8. Manufacturer and model.
  9. Operation pass/fail/reset.

### 3.11 PLUMBING SYSTEMS

- A. Pump Data:
1. Drawing symbol.
  2. Service.
  3. Manufacturer, size, and model.
  4. Impeller size: specified, actual, and final (if trimmed).
  5. Flow Rate (gpm): specified and actual.
  6. Pump Head: specified, operating and shutoff.
  7. Suction Pressure: operating and shutoff.
  8. Discharge Pressure: operating and shutoff.

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### B. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, model, frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps for each phase.

### C. Balancing Valve:

1. Drawing symbol.
2. Service.
3. Location.
4. Size.
5. Manufacturer and model.
6. Flow rate (gpm): specified and actual.
7. Pressure drop: specified and actual.

### D. Gas Fired Water Heater:

1. Drawing symbol.
2. Service.
3. Location.
4. Manufacturer and model.
5. Capacity (Btuh): specified, nameplate, and actual.
6. Entering water temperature: specified and actual.
7. Leaving water temperature: specified and actual.
8. Pressure Drop: specified and actual.
9. Control Setting: specified and actual.

**END OF SECTION 23 0593**



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**SECTION 23 0713  
DUCTWORK INSULATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Ductwork Insulation.
- B. Insulation Jackets.

**1.2 QUALITY ASSURANCE**

- A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.
- B. Materials:
  - 1. Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
  - 2. Fungal Resistance: No growth when tested in accordance with ASTM G21 (antifungal test).
  - 3. Rated velocity on coated air side for air erosion in accordance with UL 181 at 5,000 fpm minimum.
  - 4. UL listed in Category HNKT.
- C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

**1.3 REFERENCES**

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM E84 - Surface Burning Characteristics of Building Materials.
- E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.
- F. ASTM E814 - Fire Tests of Through Penetrations Firestops.
- G. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- I. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

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- J. NFPA 96 - Standard for the Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- K. NFPA 255 - Surface Burning Characteristics of Building Materials.
- L. UL - XHEZ - Through Penetration Firestop Systems.
- M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.
- N. UL 263 - Full Scale External Fire Tests with Hose Stream.
- O. UL 723 - Surface Burning Characteristics of Building Materials.
- P. UL 1479 - Fire Tests of Through Penetrations Firestops.

### 1.4 SUBMITTALS

- A. Submit shop drawings per Section 230500. Include product description, list of materials and thickness for each service, and location.
- B. Submit manufacturer's installation instructions.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.
- B. Type B: Semi-rigid Fiberglass Board Wrap - Outside Application; ANSI/ASTM C612, Class 1; 0.25 maximum 'K' value at 75°F; foil scrim Kraft facing, 3 lb./cu. ft. density.
- C. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 5000 fpm air velocity.
- D. Type D: Rigid Fiberglass Liner; 0.23 maximum 'K' value at 75°F; smooth coated mat facing laminated to the insulation, suitable for 5000 fpm air side velocity.
- E. Type E: Double wall ductwork insulation; fiberglass; 0.27 maximum 'K' value at 75°F mean temperature; 1.5 lb/cu ft density.
- F. Type F: Flexible High Temperature Wrap; ASTM E2336 rating as 2-hour separation with zero clearance to combustible materials over the full length. Material to be totally scrim encapsulated. Material to be a minimum 1-1/2" thick with a minimum core density of 6 pcf. Wrap system should offer zero clearance to combustibles per ASTM E2336 at all locations, comply with all applicable codes, and be approved by AHJ. If system is not rated for zero clearance per ASTM E2336 at all locations with single layer, a two-layer system shall be provided with zero clearance per ASTM E2336 at all locations. Material must be tested and listed for installation on grease ducts and installed per listed design. Refer to Section 233300 for prefabricated, pre-insulated access doors required for grease duct systems.

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- G. Type G: Preformed rigid fiberglass acoustical liner. ANSI/ASTM C1071; 0.23 maximum 'K' value at 75°F mean temperature; Noise Reduction Coefficient (NRC) per ASTM C423 Type "A" mounting of 0.70 [0.75] for 1" thickness, 0.90 for 1.5" thickness. Liner shall be factory coated with an anti-microbial agent to prevent fungus and bacteria growth per ASTM G-21 and G-22. Listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
- H. Type I: Flexible Elastomeric Liner; EPDM (NBR/PVC Blend is not permitted) Elastomeric cellular foam sheet; ANSI/ASTM C534; 0.25 maximum 'K' value at 75°F; listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code; coated air side for 5000 fpm air velocity.

Flexible Fiberglass Outside Wrap	0.28			5.4	7.1	8.9	10.7	14.3	17.9
Semi-Rigid Fiberglass Board Wrap	0.25			6.0	8.0	10.0	12.0	16.0	20.0
Flexible Fiberglass Liner	0.28	1.8	3.6	5.4	7.1	8.9	10.7	14.3	17.9
Rigid fiberglass liner	0.23		4.3	6.5	8.7	10.9	13.0	17.4	21.7
Double Wall Ductwork	0.27		3.7	5.6	7.4	9.3	11.1	14.8	18.5
Flexible High Temp									
Rigid Preformed Fiberglass Acoustical Liner	0.23		4.3	6.5	8.7	10.9	13.0	17.4	21.7

**2.2 JACKETS**

- A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

**2.3 JACKET COVERINGS**

- A. Aluminum Jackets: ASTM B209; 0.016" thick; smooth or embossed stucco finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.
- B. Stainless Steel Jackets: Type 316 stainless steel; 0.010" thick; smooth finish with Z edge seams and stainless steel bands for outdoor use.
- C. Laminated flexible aluminum, self-adhering, protective jacketing, vapor barrier and weather proofing membrane with having high-performance adhesive capable of installation with no additional mechanical attachment. [White finish.][Owner/Architect shall select from manufacturer's standard finishes.]
  - 1. Acceptable Manufacturers:
    - a. VentureClad 1577CW
    - b. Polyguard Alumaguard

**PART 3 - EXECUTION**

**Ductwork Insulation - 23 0713**

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### 3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.
- B. Install materials after ductwork has been tested.
- C. Clean surfaces for adhesives.
- D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.
- E. Interior Insulation - Flexible Duct Liner, Type C:
  - 1. Observation of Duct Lining:
    - a. After installation of ductwork, Architect/Engineer may select random observation points in each system.
      - 1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.
      - 2) Random observation points based on one opening per 75 lineal ft. of total duct run.
    - b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
    - c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
    - d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 23 3300.
    - e. Paint or finish to match adjacent duct surfaces.
  - 2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
  - 3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
  - 4. Install per the latest edition of the SMACNA Manual.
  - 5. Leading edges shall be covered as follows:
    - a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.

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- b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
  - c. Install metal nosing in the following locations (regardless of velocity):
    - 1) The first three fittings downstream of all fans.
    - 2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
    - 3) Trailing edges of transverse joints do not require metal nosings.
  - 6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.
  - 7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
  - 8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.
- F. Exterior Fire Protection, Flexible Type - Type F:
- 1. Cut and secure duct wrap around ductwork, support angles, and hangers per manufacturer's recommendations.
  - 2. Seal all joints as required to maintain enclosure rating.
  - 3. Installation shall be rated for 2 hours, unless otherwise noted.
  - 4. Provide manufacturer's recommended assembly to protect all access doors to maintain enclosure rating and to permit easy replacement of insulation.
- G. Exterior Duct Wrap - Type I:
- 1. On ducts with any sides having a dimension 20" and greater: Impale insulation on spindle anchors welded or mechanically fastened to the duct and secured with speed clips. Clip pins off close to speed clips. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins within 4" from edges and at intervals not over 16" in all directions. Pins shall be long enough to prevent compressing the insulation.
- H. Continue insulation with vapor barrier through penetrations unless code prohibits.
- I. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

### 3.2 SCHEDULE

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A. Refer to Section 23 3100 for scheduling of insulation.

**END OF SECTION 23 0713**

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**SECTION 23 0800  
COMMISSIONING OF HVAC**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Description
- B. Responsibilities
- C. Related Work

**1.2 DESCRIPTION**

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in the Commissioning Plan (Cx Plan). Refer to Section 01 9113.
- C. Commissioning requires the participation of the Division 23 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 9113. Division 23 Contractor shall be familiar with all parts of Section 01 9113 and the commissioning plan issued by the CxA, and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

**1.3 RESPONSIBILITIES**

- A. Refer to the Cx Plan in the appendix of Section 01 9113.

**1.4 RELATED WORK**

- A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.
  - 1. Section 01 7800 - Closeout Procedures and Submittals
  - 2. Section 01 7900 - Demonstration and Training
  - 3. Section 01 9113 - General Commissioning Requirements
  - 4. Section 21 0800 - Commissioning of Fire Suppression
  - 5. Section 22 0800 - Commissioning of Plumbing
  - 6. Section 26 0800 - Commissioning of Electrical
  - 7. Section 27 0800 - Commissioning of Communications
  - 8. Section 28 0800 - Commissioning of Electronic Safety and Security

**PART 2 - PRODUCTS**

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**PART 3 - EXECUTION**

**END OF SECTION 23 0800**

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**SECTION 23 0900  
CONTROLS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Complete System of Automatic Controls.
- B. Control Devices, Components, Wiring and Material.
- C. Instructions for Owners.
- D. Remodeling.

**1.2 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.
- B. TCC: Company specializing in the work of this section with minimum five years temperature control experience.
- C. Technician: Minimum five years' experience installing commercial temperature control systems.
- D. TCCs are limited to firms regularly employing a minimum of five full-time temperature control technicians within 100 miles of the job site.
- E. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under this section, and as restricted under the Division 26 Electrical of these specifications.

**1.3 REFERENCES**

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/ASHRAE Standard 135-2001: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.
- D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).
- E. ANSI/NFPA 70 - National Electrical Code.
- F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.
- G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.

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- I. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- J. ANSI/ASTM B32 - Solder Metal.
- K. ASTM B280 - Seamless Copper Tube for Air Conditioning & Refrigeration Field Service.
- L. ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.

### 1.4 SUBMITTALS

#### A. Equipment Coordination:

- 1. The Controls Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
- 2. Control valve selections shall be based on flow rates shown in approved shop drawings.
- 3. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

#### B. Shop Drawings:

- 1. Submit shop drawings per Section 23 0500. In addition, submit an electronic copy of the shop drawings in Adobe Acrobat (.pdf) format to the Owner for review.
- 2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
- 3. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.
- 4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels. The architecture shall include interface requirements with other systems including, but not limited to, security systems, lighting control, fire alarm, elevator status, and power monitoring system.
- 5. Diagrams shall include:
  - a. Wiring diagrams and layouts for each control panel showing all termination numbers.
  - b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
  - c. Identification of all control components connected to emergency power.
  - d. Schematic diagrams for all field sensors and controllers.
  - e. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the

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- system.
- f. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
  - g. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
  - h. All installation details and any other details required to demonstrate that the system will function properly.
  - i. All interface requirements with other systems.
6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.
  7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Architect/Engineer. Clearly highlight any deviations from the specified sequences on the submittals.
  8. Points List Schedule: Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems (security systems, lighting control, fire alarm, etc.). Provide points lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.
  9. Damper Schedule: Schedule shall include a separate line for each damper and a column for each of the damper attributes:
    - a. Damper Identification Tag.
    - b. Location.
    - c. Damper Type.
    - d. Damper Size.
    - e. Duct Size.
    - f. Arrangement.

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- g. Blade Type.
  - h. Velocity.
  - i. Pressure Drop.
  - j. Fail Position.
  - k. Actuator Identification Tag.
  - l. Actuator Type.
  - m. Mounting.
10. Valve Schedule: Valve manufacturer shall size valves and create a valve schedule. Schedule shall include a separate line for each valve and a column for each of the valve attributes:
- a. Valve Identification Tag.
  - b. Location.
  - c. Valve Type.
  - d. Valve Size.
  - e. Pipe Size.
  - f. Configuration.
  - g. Flow Characteristics.
  - h. Capacity.
  - i. Valve CV.
  - j. Design Pressure Drop.
  - k. Pressure Drop at Design Flow.
  - l. Fail Position.
  - m. Close-off Pressure.
  - n. Valve and Actuator Model Number and Type.
11. Indoor modular air handling units (Section 23 7313) and mixed flow return air fans (Section 233413) provided under this project will have piezometer type sensors mounted at fan inlets by fan manufacturer. Fan manufacturer will provide fan specific flow coefficients and equations that can be used to calculate fan airflow based on measured pressure differential at fan inlet. TCC shall provide the following:
- a. Quantity of pressure transducers so that each individual fan is served by a dedicated pressure transducer. Each pressure transducer shall have a range that is selected based on scheduled

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maximum airflow for each fan. TCC shall submit a schedule that shows the following calculations for each fan/pressure transducer:

- 1) Pressure drop at maximum scheduled airflow for each fan using fan manufacturer's flow coefficient.
  - 2) Recommended transducer range.
- b. Pneumatic tubing as required to interconnect all piezometer type sensors and pressure transducer. Note: Where UV lamps are installed upstream of supply fan inlets, only copper tubing shall be used.
  - c. Fasteners and supports as required to securely attached tubing, pressure transducers, conduits, wiring, and the like for a complete installation.
12. Airflow Measuring Station Schedule:
- a. The manufacturer's authorized representative shall prepare the airflow measuring station submittal, or review and approve in writing the submittal prepared by the TCC prior to submission to the Architect/Engineer and prior to installation. The representative shall review air handling equipment submittals and duct fabrication drawings to ensure that all AFMS locations meet the appropriate parameters to achieve proper installation and the specified accuracy. Comply with all manufacturer's installation requirements including straight up and downstream duct lengths. Install airflow straighteners if required by the manufacturer based on installation constraints. The Architect/Engineer shall be notified for approval of any deviations.
  - b. Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system.
  - c. Submit installation, operation, and maintenance documentation.
13. Product Data Sheets: Required for each component that includes: unique identification tag that is consistent throughout the submittal, manufacturer's description, technical data, performance curves, installation/maintenance instructions, and other relevant items. When manufacturer's literature applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements.
14. Provide PICS files indicating the BACnet functionality and configuration of each device.
15. Provide documentation of submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL), or provide a letter on the manufacturer's company letterhead indicating the anticipated date by which testing is expected to be completed. If, for any reason, BTL testing and listing has not been completed, a written commitment to upgrade installed controls to a version that meets BTL testing and listing requirements if problems are found during BTL testing is required.

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16. Graphic Display: Include a sample graphic of each system and component identified in the points list with a flowchart (site map) indicating how the graphics are to be linked to each other for system navigation.
  17. Software: A list of operating system software, operator interface software, color graphic software, and third-party software.
  18. Control System Demonstration and Acceptance: Provide a description of the proposed process, along with all reports and checklists to be used.
  19. Clearly identify work by others in the submittal.
  20. Quantities of items submitted may be reviewed but are the responsibility of the Contractor to verify.
- C. Operation and Maintenance Manual:
1. In addition to the requirements of Section 23 0500, submit an electronic copy of the O&M manuals in PDF format.
  2. Provide three complete sets of manuals.
  3. Each O&M manual shall include:
    - a. Table of contents with indexed tabs dividing information as outlined below.
    - b. Definitions: List of all abbreviations and technical terms with definitions.
    - c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
    - d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.
    - e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
    - f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
    - g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
    - h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.

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- i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
  - j. Software: One set of CDs containing an executable copy of all custom software created using the programming language, including the setpoints, tuning parameters, and object database.
  - k. Graphics: A glossary or icon symbol library detailing the function of each graphic icon and graphics creation and modification. One set of CDs containing files of all color graphic screens created for the project.
- D. Training Manual:
- 1. Provide a course outline and training manuals for each training class.
- E. Record Documents:
- 1. Submit record documentation per Section 23 0500.
  - 2. Provide a complete set of "as-built" drawings and application software on CDs. Provide drawings as AutoCAD or Visio compatible files. Provide two copies of the "as-built" drawings with revisions clearly indicated in addition to the documents on compact disk. All as-built drawings shall also be installed on the FMCS server in a dedicated directory. Provide all product data sheets in PDF format.
  - 3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.
  - 4. Provide all completed testing and commissioning reports and checklists, along with all trend logs for each system identified in the points lists.
  - 5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the A/E verifying completion and proper operation of all points.

### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
- B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

### 1.6 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Control Valves.
- B. Flow Switches.
- C. Temperature Sensor Sockets.

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- D. Gauge Taps.
- E. Automatic Dampers.
- F. Flow Meters.

### 1.7 AGENCY AND CODE APPROVALS

- A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.
  - 1. UL-916; Energy Management Systems.
  - 2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."
  - 3. EMC Directive 89/336/EEC (European CE Mark).
  - 4. FCC, Part 15, Subpart J, Class A Computing Devices.

### 1.8 ACRONYMS

- A. Acronyms used in this specification are as follows:
  - 1. B-AAC BACnet Advanced Application Controller
  - 2. B-ASC BACnet Application Specific Controller
  - 3. BTL BACnet Testing Laboratories
  - 4. DDC Direct Digital Controls
  - 5. FMCS Facility Management and Control System
  - 6. GUI Graphic User Interface
  - 7. IBC Interoperable BACnet Controller
  - 8. IDC Interoperable Digital Controller
  - 9. LAN Local Area Network
  - 10. NAC Network Area Controller
  - 11. ODBC Open DataBase Connectivity
  - 12. OOT Object Oriented Technology
  - 13. OPC Open Connectivity via Open Standards
  - 14. PICS Product Interoperability Compliance Statement
  - 15. PMI Power Measurement Interface
  - 16. POT Portable Operator's Terminal



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17. TCC Temperature Control Contractor
18. TCS Temperature Control System
19. WAN Wide Area Network
20. WBI Web Browser Interface

### 1.9 SUMMARY

- A. Provide new standalone FMCS for this project.
- B. Extend Existing System:
  1. Extend the existing FMCS for this project.
  2. All controllers and accessories shall interface with the existing FMCS.
- C. Owner Furnished System:
  1. Owner will furnish FMCS panels, sensors, etc. installed under this contract. Reference control diagrams issued with these documents for required monitoring by this system.
  2. The Temperature Control Contractor (TCC) shall receive, store, protect and install the FMCS products supplied by the Owner. These will consist of FMCS panels and subassemblies, prewired outboard gear cabinets (prewired to terminal strips), and those input sensors identified in the project points lists. All work to install this equipment, as well as the necessary piping and wiring, are the responsibility of the TCC. The TCC shall also receive control system drawings provided by the FMCS system manufacturer. The TCC shall create integrated system drawings showing all work provided by the TCC and by the Owner. The Owner will provide a completely functioning operating software package for each FMCS Panel. The Owner will employ the manufacturer to commission the FMCS system hardware. The TCC shall provide manpower at the jobsite whenever the Owner's FMCS supplier is commissioning the system.
- D. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using Direct Digital Controls as shown on the drawings and as described herein.
- E. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.
- F. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.
- G. Provide Critical Environment Control System (refer to Section 230920)

### 1.10 SYSTEM DESCRIPTION

- A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.

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- B. The FMCS shall include Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, either locally in each building or remotely from a central site or sites, through standard Web browsers, via the Internet, and/or via local area network.
- C. Provide materials and labor necessary to connect factory supplied control components.
- D. Provide central and remote hardware, software, and interconnecting wire and conduit.
- E. The FMCS shall include automated alarming software capable of calling e-mail compatible cellular telephones and pagers. The e-mail alarm paging system shall be able to segregate users, time schedules, and equipment and be capable of being programmed by the Owner.
- F. For the dedicated configuration tool provided, it is preferable that it be launched from within the applicable Network Management Software. If not, include any software required for controller configuration as a leave-behind tool with enough license capability to support the installation.
- G. For each operator workstation provided, furnish one legal copy of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be readily available in the market. Contractor shall convey to the Owner all software tools and their legal licenses at project closeout.

### 1.11 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

### 1.12 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

### 1.13 WARRANTY

- A. Refer to Section 23 0500 for warranty requirements.
- B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.

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- C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.
- D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

### 1.14 WARRANTY ACCESS

- A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. BACnet Protocol:
  - 1. Alerton
  - 2. Automated Logic: WebCTRL
  - 3. Delta Controls: ORCA
  - 4. Honeywell
  - 5. Johnson Controls: Metasys Extended Architecture
  - 6. KMC
  - 7. Siemens Building Technologies: APOGEE
  - 8. Schneider Electric - EcoStruxure Building Operation
  - 9. Trane Tracer SC
  - 10. Distech Controls
- B. LonTalk Protocol:
  - 1. Honeywell
  - 2. Johnson Controls: Metasys Extended Architecture
  - 3. Schneider Electric - EcoStruxure Building Operation
  - 4. Trane Tracer SC
  - 5. Distech Controls

### 2.2 SYSTEM ARCHITECTURE

- A. General:

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1. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers, a computer system, graphic user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.
  2. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.
- B. Open, Interoperable, Integrated Architectures:
1. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data are not acceptable.
  2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs are not acceptable.
  3. Hierarchical or "flat" topologies are required to have system response times as indicated below and to manage the flow and sharing of data without unduly burdening the customer's internal intranet network.
    - a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
    - b. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

### 2.3 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP. Provide support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.
- B. Local area network minimum physical and media access requirements:
  1. Ethernet; IEEE Standard 802.3.
  2. Cable; 100 Base-T, UTP-8 wire, Category 6.
  3. Minimum throughput; 100 Mbps.
- C. Communication conduits shall not be installed closer than six feet from 110VAC or higher transformers or run parallel within six feet of electrical high-power cables. Route the cable as far from interference generating devices as possible. Where communication wire must cross 110VAC or higher wire, it must do so at right angles.

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- D. Ground all shields (earth ground) at one point only to eliminate ground loops. Provide all shield grounding at the controller location, with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.
- E. There shall be no power wiring more than 30 VAC rms run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, run all communication wiring and signal wiring using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices.

### 2.4 REMOTE NETWORK ACCESS

- A. For Local Area Network installations, provide access to the LAN from a remote location via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

### 2.5 NETWORK AREA CONTROLLER (NAC)

- A. The TCC shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of NACs required depends on the type and quantity of devices provided under Divisions 23 and 26. The TCC shall determine the quantity and type of devices.
- B. Each NAC shall provide the interface between the LAN or WAN and the field control devices and shall provide global supervisory control functions over the control devices connected to the NAC. It shall execute application control programs to provide:
  - 1. Calendar functions.
  - 2. Scheduling.
  - 3. Trending.
  - 4. Alarm monitoring and routing.
  - 5. Time synchronization.
  - 6. Integration of all controller data.
  - 7. Network Management functions.
- C. The Network Area Controller shall provide the following hardware features as a minimum:
  - 1. One Ethernet Port - 10/100 Mbps.
  - 2. One RS-232 port.
  - 3. One LonWorks Interface Port - 78KB FTT-10A (for LonWorks systems only).
  - 4. One RS-485 port.
  - 5. Battery backup.

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6. Flash memory for long-term data backup. (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity.)
  7. The NAC must be capable of operation over a temperature range of 32°F to 122°F.
  8. The NAC must be capable of withstanding storage temperatures of between 0°F and 158°F.
  9. The NAC must be capable of operation over a humidity range of 5% RH to 95% RH, non-condensing.
- D. The NAC shall provide multiple user access to the system and support for ODBC or SQL. Databases resident on the NAC shall be ODBC-compliant or must provide an ODBC data access mechanism to read and write data stored within it.
- E. The NAC shall support standard Web browser access via the Internet or an intranet and a minimum of five (5) simultaneous users.
- F. Event Alarm Notification and Actions:
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
  2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a LAN, remote via dial-up telephone connection, or WAN.
  3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
    - a. Alarm
    - b. Normal
  4. Provide for the creation of a minimum of eight alarm classes with different routing and acknowledgement properties, e.g. security, HVAC, Fire, etc.
  5. Provide timed (scheduled) routing of alarms by class, object, group, or node.
  6. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- G. Treat control equipment and network failures as alarms and annunciated.
- H. Annunciate alarms in any of the following manners as defined by the user:
1. Screen message text.
  2. E-mail of the complete alarm message to multiple recipients. Provide the ability to route and e-mail alarms based on:
    - a. Day of week.

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- b. Time of day.
- c. Recipient.
- 3. Pagers via paging services that initiate a page on receipt of e-mail message.
- 4. Graphic with flashing alarm object(s).
- 5. Printed message, routed directly to a dedicated alarm printer.
- I. The FMCS shall record the following for each alarm:
  - 1. Time and date.
  - 2. Location (building, floor, zone, office number, etc.).
  - 3. Equipment tag.
  - 4. Acknowledge time, date, and user who issued acknowledgement.
  - 5. Number of occurrences since last acknowledgement.
- J. Give defined users proper access to acknowledge any alarm.
- K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- L. Provide a "query" feature to allow review of specific alarms by user-defined parameters.
- M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- N. An error log to record invalid property changes or commands shall be provided and available for review by the user.

### 2.6 GRAPHIC USER INTERFACE SOFTWARE

- A. Operating System:
  - 1. Provide computer with the most current Microsoft-based operating system with which the GUI has proven compatibility.
- B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu pulldowns and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line) that displays the location and the selected object identification.
- C. Point Organization: Organize points by equipment categories, location, or other means acceptable to Owner.
- D. Real-Time Displays: The GUI shall support the following graphic features and functions:

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1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file. Use of proprietary graphic file formats is not acceptable. In addition to, or in lieu of, a graphic background, the GUI shall support the use of scanned pictures.
  2. Graphic screens shall be able to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URLs, and links to other graphic screens.
  3. Graphics shall support layering, and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
  4. Modifying common application objects, such as schedules, calendars, and setpoints, shall be accomplished graphically.
    - a. Schedule times shall be adjusted using a graphic slider without requiring any keyboard entry from the operator.
    - b. Holidays shall be set by using a graphic calendar without requiring any keyboard entry from the operator.
  5. Commands to start and stop binary objects shall be made by selecting the object and the appropriate command from a pop-up menu. No text entry shall be required.
  6. Adjustments to analog objects, such as setpoints, shall be made by selecting the object and using a graphic slider to adjust the value. No text entry shall be required.
- E. System Configuration: At a minimum, the GUI shall include the necessary software and components to enable the operator to perform the following tasks with proper password access:
1. Create, delete or modify control strategies.
  2. Add/delete objects.
  3. Tune control loops by adjusting control loop parameters.
  4. Enable or disable control strategies.
  5. Generate hard copy records or control strategies on a printer.
  6. Select alarm points and define the alarm state.
  7. Select points to be trended and initiate the recording of values automatically.
  8. View any trend as a graph.
- F. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available using hypertext. All system documentation and help files shall be in HTML format.
- G. Security: Each operator shall be required to log on to that system with a user name and password to view, edit, add, or delete data. System security shall be selectable for each operator. The system



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administrator shall be able to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall be automatically logged off the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. Store all system security data in an encrypted format.

- H. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. Annunciate the failure of any device to the operator.
- I. Alarm Console:
  - 1. The system shall have a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and to acknowledge the alarm.
  - 2. When the alarm console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator are not acceptable. The use of the alarm console can be enabled or disabled by the system administrator.

### 2.7 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer, Firefox, or Chrome. Systems requiring additional software to enable a standard Web browser to reside on the client machine, or manufacturer-specific browsers, are not acceptable.
- B. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphic User Interface. Systems that require different views or that require different means of interacting with objects, such as schedules or logs, are not permitted.
- C. The Web browser client shall provide:
  - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, display a blank web page. Implement security using Java authentication and encryption techniques to prevent unauthorized access.
  - 2. Graphic screens developed for the GUI shall be the same screens used for the Web browser client. The web browser interface shall support all animated graphic objects supported by the GUI.
  - 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
  - 4. Store all graphic screens in the Network Area Controller (NAC) without requiring any graphics storage on the client machine.
  - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

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6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
  - a. Modify common application objects, such as schedules, calendars, and setpoints, graphically.
    - 1) Schedule times shall be adjustable using a graphic slider, without requiring any keyboard entry from the operator.
    - 2) Holidays shall be set using a graphic calendar, without requiring any keyboard entry from the operator.
  - b. Commands to start and stop binary objects shall be made by right-clicking the selected object and selecting the appropriate command from a pop-up menu. No text entry shall be required.
  - c. View logs and charts.
  - d. View and acknowledge alarms.
  - e. Setup and execute SQL queries on log and archive information
7. The system shall be able to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just his/her defined home page. From the home page, links to other views or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on intranet sites by specifying the Uniform Resource Locator (URL) for the desired link.

### 2.8 SERVER FUNCTIONS AND HARDWARE

- A. Provide a central server located at [Insert]. The server shall support all NACs connected to the customer's network whether local or remote.
- B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1, or dial-up connection.
- C. It shall be possible to provide access to all NACs via a single connection to the server. In this configuration, each NAC can be accessed from a remote GUI or from a standard WBI by connecting to the server.
- D. The server shall provide the following functions:
  1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
  2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
  3. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.

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4. The server shall accept time synchronization messages from trusted precision atomic clock Internet sites and update its master clock based on this data.
5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
6. The server shall provide demand limiting that operates across all NACs. The server must be capable of running multiple demand programs for sites with multiple meters and/or multiple sources of energy. Each demand program shall be able to support separate demand shed lists.
7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs.
8. Each NAC supported by the server shall be able to automatically archive its log data, alarm data and database to the server. Archiving options shall be user-defined, including archive time and archive frequency.
9. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include:
  - a. Routing alarms to display, printer, e-mail, and pagers.
  - b. Viewing and acknowledging alarms.
  - c. Querying alarm logs based on user-defined parameters.
10. The server shall provide central management of log data for all NACs supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
  - a. Viewing and printing log data.
  - b. Exporting log data to other software applications.
  - c. Querying log data based on user-defined parameters.
11. Reports shall be generated automatically or manually, and directed to LCD displays, printers, or disk files. The system shall allow the user to easily obtain the following types of reports:
  - a. List all points in network.
  - b. List all points in alarm.
  - c. List all off-line points.
  - d. List all points in override status.
  - e. List all disabled points.
  - f. List all points that are locked out.
  - g. List all items defined in a "follow-up" file.

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- h. List all weekly and holiday schedules.
- i. List all limits and deadbands.

### E. Server Hardware Requirements:

1. Provide a High-Mid Range CPU as defined by [www.cpubenchmark.net](http://www.cpubenchmark.net) (minimum processing speed of 2.9 GHz with 8.0 GB RAM and a 1-terabyte minimum hard drive). It shall include one parallel port, one asynchronous serial port and four USB ports. Include a 21" minimum flat panel color monitor, 8ms response time.
2. The server operating system shall be the latest version of Microsoft Windows and Microsoft internet browser.
3. Connect to the FMCS network via an Ethernet network interface card, 1 Gbps.
4. Provide a color laser printer with a minimum 600 x 600-dpi resolution and 12 ppm print speed.
5. For dedicated alarm printing, provide a continuous feed printer using roll or fan-fed microperforated paper. The printer shall have a parallel port interface.

### 2.9 GRAPHIC USER INTERFACE COMPUTER HARDWARE (LAPTOP COMPUTER)

- A. Provide a High-Mid Range CPU as defined by [www.cpubenchmark.net](http://www.cpubenchmark.net) with 8 GB RAM and 750-gigabyte minimum hard drive. Laptop computer shall be equipped with minimum 15" screen.
- B. The workstation operating system shall be the latest version of Microsoft Windows and Microsoft internet browser.
- C. Connect to the FMCS network via a 10/100 Mbps Ethernet network interface card.
- D. Provide a color laser system printer with a minimum 600 x 600-dpi resolution and 12 ppm print speed.

### 2.10 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. A UPS shall be provided for each of the following:
  1. FMCS workstations and servers.
  2. Network area controllers.
  3. Chiller plant manager.
  4. Boiler plant manager.
- B. Provide a 120-volt 60 Hz line-interactive uninterruptible power supply with backup battery capacity for 5 minutes at 100% load. UPS shall have hot swappable batteries, automatic battery self-test and start-on-battery capabilities. Batteries shall be valve regulated, sealed lead acid type. UPS shall have sine wave shape output waveform. UPS shall be UL 1778 list and comply with FCC Part 15, Class A.
  1. Manufacturers:
  2. Sola/Hevi-Duty

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3. Eaton Powerware
4. APC

### 2.11 SYSTEM PROGRAMMING

- A. The GUI software shall perform system programming and graphic display engineering. Access to the GUI software shall be through password access as assigned by the system administrator.
- B. Provide a library of control, application, and graphic objects to enable creation of all applications and user interface screens. Applications shall be created by selecting the control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphic connection tool. Completed applications may be stored in the library for future use. GUI screens shall be created in the same fashion. Data for the user displays shall be obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Provide all software tools or processes to create applications and user interface displays.
- C. Programming Methods:
  1. Provide the capability to copy objects from the supplied libraries or from a user-defined library to the user's application. Link objects with a graphic linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; e.g., internal, external, hardware, etc.
  2. Configuration of each object shall be done through the object's property sheet using fill-in-the-blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration is not acceptable.
  3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
  4. All programming shall be done in real time. Systems requiring the uploading, editing, and downloading of database objects are not allowed.
  5. The system shall support object duplication in a customer's database. An application, once configured, can be copied and pasted for easy reuse and duplication. All links, other than to the hardware, shall be maintained during duplication.

### 2.12 DDE DEVICE INTEGRATION

- A. The NAC shall support the integration of device data via Dynamic Data Exchange (DDE) over the Ethernet network. The NAC shall act as a DDE client to another software application that functions as a DDE server.

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- B. Provide the required objects in the library included with the Graphic User Interface programming software to support the integration of these devices into the FMCS. Objects provided shall include, at a minimum:
  - 1. DDE Generic AI Object.
  - 2. DDE Generic AO Object.
  - 3. DDE Generic BO Object.
  - 4. DDE Generic BI Object.

### 2.13 MODBUS SYSTEM INTEGRATION

- A. The NAC shall support integration of device data from Modbus RTU, ASCII, and TCP control system devices. Connect to the Modbus system via an RS-232, RS485, or Ethernet IP as required by the device.
- B. Provide the required objects in the library included with the GUI programming software to support the integration of the Modbus system data into the FMCS. Objects provided shall include, at a minimum:
  - 1. Read/Write Modbus AI Registers.
  - 2. Read/Write Modbus AO Registers.
  - 3. Read/Write Modbus BI Registers.
  - 4. Read/Write Modbus BO Registers.
- C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the Modbus system devices.
- D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment using Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

### 2.14 OPC SYSTEM INTEGRATION

- A. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP. The OPC client shall support third-party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.
- B. Provide the required objects in the library included with the GUI programming software to support the integration of the OPC system data into the FMCS. Objects provided shall include:
  - 1. Read/Write OPC AI Object.
  - 2. Read/Write OPC AO Object.
  - 3. Read/Write OPC BI Object.
  - 4. Read/Write OPC BO Object.

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5. Read/Write OPC Date/Time Input Object.
  6. Read/Write OPC Date/Time Output Object.
  7. Read/Write OPC String Input Object.
  8. Read/Write OPC String Output Object.
- C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the OPC system devices.
- D. The FMCS supplier shall provide an OPC client communications driver. The vendor that provided the equipment using OPC shall provide documentation of the system's OPC server interface and shall provide free factory support during system commissioning.

### 2.15 SOFTWARE

- A. IDC/IBCs shall operate totally standalone and independent of a central computer for all specified control applications.
- B. Software shall include a complete operating system (OS), communications handler, point processing, energy management application packages as specified herein, standard control algorithms and specific control sequences (IDC/IBC) and an Owner/user custom control calculation package complete with interpreter.
- C. OS software shall be PROM resident, operate in real time, provide prioritized task scheduling, control time programs, monitor and manage communications, and scan inputs and outputs.
- D. Each IDC/IBC panel shall include the following energy management routines:
1. Time of day scheduling.
  2. Optimum start/stop.
  3. Peak demand limiting.
  4. Economizer control.
  5. PID control.
  6. Supply air reset.
  7. Outdoor air reset.
- E. Input/output point processing software shall include:
1. Update of all connected input and output points at least once per second.
  2. Analog to digital conversion, scaling and offset, correction of sensor non-linearity, sensing no response or failed sensors, and conversion of values to 32-bit floating point format. Retain both the maximum and minimum values sensed for each analog input in memory. It shall be possible to input subsets of standard sensor ranges to the A/D converter and assign gains to match the full-

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scale 32-bit conversion to achieve high accuracy readout.

3. A reasonability check on all analog inputs against previous values and discarding of values falling outside preprogrammed reasonability limits.
  4. Assignment of proper engineering units and status conditions to all inputs and outputs.
  5. Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and alarm) to an input or to assign a set of floating limits (alarm a reset schedule or FMCS control point) to the input. Assign each alarm a unique differential to prevent a point from oscillating in and out of alarm. Make alarm comparisons of each scan cycle.
  6. Adjustment of timing from two seconds to two minutes in one-second increments to eliminate nuisance alarms on startup.
- F. Command Control software shall manage the receipt of commands from the server and from control programs.
1. Provide command delay to prevent simultaneous energizing of loads. Delay must be programmable from 0 to 30 seconds.
  2. Assign each command a command and residual priority to manage conflicts created by multiple programs having access to the same command point. Allow only outputs with a higher command priority to execute. Whenever a command is allowed to execute, its assigned residual priority shall replace the existing residual priority.
  3. A "fixed mode" option (override) shall allow inputs to and outputs from control programs to set to a fixed state or value. When in the "fixed mode", assign inputs and outputs high residual command priority to prevent override by application programs.
- G. Alarm lockout software shall prevent nuisance alarms. On initial start-up of mechanical equipment, assign a "timed lockout" period to analog points to allow them to reach a stable condition before activating alarm comparison logic. Lockout period shall be programmable for each point from 0 to 90 minutes in one-minute increments.
- H. A "hard lockout" shall also be provided to positively lock out alarms when equipment is turned off or when a true alarm depends on the condition of an associated point. Hard lockout points and lockout initiators shall be operator programmable.
- I. Runtime shall be accumulated based on the status of a digital input point. It shall be possible to totalize either on time or off time up to 10,000 hours with one-minute resolution. Runtime counts shall reside in non-volatile memory and have DCP resident runtime limits assignable through the operator's terminal.
- J. A transition counter shall count the number of times a device is cycled on or off. Counter shall be non-volatile and capable of counting 600,000 cycles. Limits shall be assignable to counts to provide maintenance alarm printouts.
- K. Custom IDC/IBC programs shall meet the control strategies called for in the sequence of operation of these specifications. Each IDC/IBC shall have resident in its memory and available to the programs a full library of IDC/IBC algorithms, intrinsic control operators, arithmetic, logic, and relational



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operators. Provide the following features:

1. Proportional Control, Proportional plus Integral (PI), Proportional plus Integral plus Derivative (PID), and Adaptive Control (self-learning). Use Adaptive Control where the controlled flow rate is variable (such as TAB units and variable flow pumping loops). The adaptive control algorithm shall monitor the loop response to output corrections and adjust the loop response characteristics in accordance with the time constant changes imposed by variable flow rates. The algorithm shall operate in a continuous self-learning manner and shall retain in memory a stored record of the system dynamics so that, on system shutdown and restart, the learning process starts from where it left off. Standard PID algorithms are not acceptable substitutes for variable flow applications since they will provide satisfactory control at only one flow rate and will require continued manual fine tuning.
  2. All IDC/IBC setpoints, gains and time constants associated with IDC/IBC programs shall be available to the operator for display and modification via the operator workstation.
  3. The execution interval of each IDC/IBC loop shall be adjustable from 2 to 120 seconds in one-second increments.
  4. IDC/IBC control programs shall assign initialization values to all outputs so controlled devices assume a failsafe position on start-up.
- L. Provide time and event programming (TEP) capability to initiate a controlled sequence of events for execution at a specific time or upon the occurrence of an event. Minimum program features required are:
1. Analog points commandable to a specific value.
  2. Digital points commandable to a specific state; e.g. on or off; fast, slow or off.
  3. Initiator to be a specific day and time or a specific event; e.g. an alarm.
  4. Manual initiation via operator's command.
  5. Commands must honor command delays (to prevent current surges), and assigned minimum ON and OFF times.
  6. Commands must honor command and residual priority structures allowing higher priority commands (like smoke control) to override lower priority commands (like time of day scheduling) and residual priority.
  7. Ability to chain TEPs.
  8. Ability to enable and disable TEPs individually.
  9. Ability to enable/disable TEP initiators.
- M. Store Energy Management application programs and associated data files in non-volatile or 72-hour battery backed RAM memory. Individual programs shall be accessible from the operator workstation for enabling/disabling and program parameter modification and shall include:
1. Time Programs:

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2. Provide an independent start and stop program time for each system identified in the points list.
3. It shall be possible to assign two independent start and stop times/days to any equipment connected to a controller.
4. Exception Day Scheduling:
  - a. Provide an Exception Day program for holiday and other planned exceptions to time programs. Exception schedules shall be DSC resident and operator programmable up to one year in advance.
  - b. The program shall allow definition of up to 32 exception time spans. Define each span by calendar start day and calendar stop day.
5. An IDC/IBC resident temporary scheduler shall allow operators to modify present time program control of equipment. Minimum feature set required is:
  - a. Ability to alter time schedules as much as six days in advance.
  - b. Ability to alter either start time, stop time or both for each day.
  - c. Temporary schedule shall be in effect for all days specified.
  - d. Automatically delete the temporary schedule and restore program to normal schedule after execution.
  - e. Ability to assign schedule changes as permanent as well as temporary.
- N. The IDC/IBC shall have built-in, non-descriptive, self-test procedure for checking the indication lights, digital display, and memory. It shall display advisories for maintenance, performance, and/or software problems.
  1. All electronics shall be:
  2. Standard locally stocked modular boards.
  3. Plug-in type.
  4. Furnish all ROM programs unlocked.

### 2.16 CONTROL DAMPERS

- A. Rectangular Control Dampers - Standard Construction:
  1. Shall be licensed to bear the AMCA Certified Rating Seal.
  2. Test leakage and pressure drop per AMCA 500.
  3. Frame: Hat-shaped channel, minimum 12 gauge extruded aluminum, and minimum 4" deep. Caulk or weld seams to prevent leakage.
  4. Blades: Minimum 12 gauge extruded aluminum airfoil design, minimum 6" wide, and overlapping blades and blade seals (overlapping blade seals only is unacceptable).

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5. Shaft: Non-cylindrical, solid [aluminum or zinc plated steel][stainless steel] with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
  6. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
  7. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.
  8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
  9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
  10. Size Limits: 48" maximum horizontal blade length, 24 square foot maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
  11. Maximum Leakage: Class 1A at 1" w.c. pressure differential for a 24" x 24" damper.
  12. Maximum Pressure Drop for Opposed Blade Damper: 0.15" for 8,000 cfm through a 24" x 24" damper (2000 fpm).
  13. Maximum Pressure Drop for Parallel Blade Damper: 0.08" for 8,000 cfm through a 24" x 24" damper (2000 fpm).
- B. Thermally Insulated Control Damper:
1. Shall be licensed to bear the AMCA Certified Rating Seal.
  2. Test leakage and pressure drop per AMCA 500.
  3. Frame: Extruded aluminum, minimum 4" deep, 0.080" minimum thickness.
  4. Thermally Broken Frame: Extruded aluminum, minimum 4" deep, 0.080" minimum thickness, flanged to duct. Entire frame shall be thermally broken using polyurethane resin pockets, complete with thermal cuts.
  5. Blades: Minimum 12 gauge extruded aluminum airfoil design, minimum 6" wide, internally insulated with expanded polyurethane foam and thermally broken, with overlapping blades and blade seals (overlapping blade seals only is unacceptable).
  6. Shaft: Non-cylindrical, solid aluminum or zinc plated steel or stainless steel shaft with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.

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7. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
  8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
  9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
  10. Size Limits: 48" maximum horizontal blade length, 24 square foot maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
  11. Maximum Leakage: Class 1A at 1" w.c. pressure differential for a 24" x 24" damper.
  12. Maximum Pressure Drop: 0.21" for 8,000 cfm through a 24" x 24" damper (2000 fpm).
- C. Round Galvanized Steel Control Dampers:
1. Test leakage and pressure drop per AMCA 500.
  2. Frame: Minimum 20 gauge galvanized steel, 10" long.
  3. Bearings: Provide thrust bearings for vertical damper applications.
  4. Blades: Two-layer galvanized steel, equivalent 14 gauge thickness with neoprene or polyethylene foam seal enclosed in two-piece blade construction up to 24", 10 gauge steel over 24".
  5. Linkage: Stainless steel, minimum 1/2" diameter shaft through 24", 3/4" shaft over 24" size. Stainless steel bearings. Shaft shall be securely keyed to blades and of sufficient length to mount direct-coupled actuator. Install damper with the shaft horizontal to the floor. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
  6. Maximum Leakage: 8 cfm maximum at 1" w.c. pressure differential for a 24" x 24" damper.
  7. Maximum Pressure Drop: 0.10" for 6,280 cfm through a 24" damper (2,000 fpm).
- D. Round Stainless Steel Control Dampers:
1. Test leakage and pressure drop per AMCA 500.
  2. Frame: Hat-shaped channel, minimum 10 gauge Type 304 stainless steel (304L or 316L for welded duct). Caulk or weld seams to prevent leakage.
  3. Bearings: Provide thrust bearings for vertical damper applications.
  4. Blades: Minimum 12 gauge Type 304 stainless steel construction. No seals are required.

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5. Linkage: Stainless steel, minimum 1/2" diameter shaft through 12", 3/4" shaft through 24", 1" shaft over 24" size. Stainless steel bearings. Shaft shall be securely keyed to blades and of sufficient length to mount direct-coupled actuator. Install damper with the shaft horizontal to the floor. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
6. Maximum Leakage: 26 cfm maximum at 1" w.c. pressure differential for a 24" x 24" damper.
7. Maximum Pressure Drop: 0.15" for 6,280 cfm through a 24" damper (2,000 fpm).

### 2.17 DAMPER ACTUATORS

#### A. Damper Actuators - Pneumatic:

- B. Pneumatic piston type with bracket arrangement for location outside the air stream whenever possible.
  1. Provide with aluminum housing and synthetic elastomer or rolling neoprene diaphragm. Actuator shall have 30 psi maximum safe operating pressure, -20°F to 150°F operating temperature range. Actuator shall be UL listed.
  2. Provide pilot positioner on all damper actuators.
  3. Select all actuators and spring ranges to operate their dampers as indicated in the control sequences with 50% additional force for future friction increases.

#### C. Damper Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Dampers: Where shown on the drawings or sequences, fail-safe mechanism shall operate the damper to the fail position following power interruption.
  - a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
  - b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 2 second, 10 second, or second operational delay.
5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.

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6. Damper End Switches: Where shown on the drawings or sequences, provide end switches to prove damper reaches open/closed position.

### 2.18 VALVE ACTUATORS

#### A. General:

1. Actuators shall be sized to operate the valve through its full range of motion and shall close against pump shutoff pressure without producing audible noise at any valve position.
2. Provide visual position indication.
3. Mount actuator directly on valve or provide linear motion assembly as required for valve type.

#### B. Valve Actuators - Pneumatic:

1. Pneumatic piston type, with synthetic elastomer or rolling neoprene diaphragm. Actuator shall have 30 psi maximum safe operating pressure, -20°F to 150°F operating temperature.
2. Provide pilot positioner on all valve actuators, except for terminal units.
3. Select all actuators and spring ranges to operate their valves as indicated in the control sequences with 50% additional force for future friction increases.

#### C. Valve Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Valves: Where shown on the drawings or sequences, fail-safe mechanism shall operate the valve to the fail position following power interruption.
  - a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
  - b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 2 second, 10 second, or second operational delay.
5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.

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### 2.19 CONTROL INSTRUMENTATION

#### A. Temperature Measuring Devices:

##### 1. Electric Thermostats:

- a. Single Temperature - Line Voltage Electric: Integral manual ON/OFF/AUTO selector switch, minimum dead band of 5°F, concealed temperature adjustment, locking cover, rated for load, single or double pole as required.
- b. Single Temperature - Low Voltage Electric: Integral manual ON/OFF/AUTO selector switch, minimum dead band of 5°F, anticipator circuits, concealed temperature adjustment, locking cover, 24 V control transformer (if not included with unit under control), single or double pole as required.

##### 2. Low Limit Switch:

- a. Provide one foot of sensing element for each one square foot of coil area, maximum element length 25 feet, of the vapor tension type, so that any point along the entire length of measuring element can trigger the switch.
- b. Provide 3" minimum radius capillary support clips at each turn.
- c. Furnish each thermostat with one single pole, single throw normally-opened switch and one single pole, single throw normally-closed auxiliary switch.
- d. Setpoint range shall be 15°F to 55°F with a permanent stop at 35°F.
- e. Differential shall be fixed at approximately 5°F and supplied with manual reset.

#### B. Temperature Sensors:

##### 1. Room Temperature Sensor:

- a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, no setpoint adjustment or override button.
- b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a single warmer/cooler or red/blue visual scale), no override button.
- c. Sensor with Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, occupied/unoccupied override button with LED, no setpoint adjustment.
- d. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range,  $\pm 0.50^\circ\text{F}$  accuracy, with exposed single setpoint

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adjustment (no numeric temperature scale - provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.

2. Duct Temperature Sensor:
  - a. Thermistor or RTD type. Pneumatic transmitters with transducers are not acceptable.
3. Water Temperature Sensor:
  - a. Install in immersion wells. Separate thermometers as specified elsewhere, also of the immersion well type, shall be installed within 2 feet of each temperature sensor.
- C. Enthalpy Sensors: Duct-mounted enthalpy sensor shall include solid state temperature and humidity sensors with electronics that shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling.
- D. Pressure Measuring Devices
  1. Differential Pressure Switches:
    - a. Standard Pressure Switches:
      - 1) Diaphragm-activated gauge with 4-3/4" dial, cast aluminum case, sealed interior, designed to resist shock and vibration, and rated for 15 psig.
      - 2) Accuracy shall be  $\pm 3\%$  of full scale maximum throughout entire range at 70°F.
      - 3) Provide mounting brackets, probes, and shutoff valves required for proper installation.
      - 4) The range and service shall be as required for application or as noted on the drawings.
      - 5) The range and services shall be as follows:
        - (a) [Insert].
      - 6) Provide two (2) photo-transistor-activated circuits and two (2) DPDT relays for both high or low limit alarms or controls.
      - 7) Provide latching relays that require manual reset once activated.
      - 8) Acceptable Manufacturer: Dwyer Photohelic Series 3000.
    - b. High Pressure Switches (Manual Reset):
      - 1) Differential pressure switch with single pole, double-throw snap switch and enclosure.
      - 2) Rated for pressure specified in sequence of control.
      - 3) Electrical rating shall be 15 amps at 120-480 volts.
      - 4) Setpoint adjustment shall be screw type located inside enclosure.



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- 5) Provide optional manual reset for overpressure protection with all tubing, brackets, and adapters.
  - 6) Repeatability:  $\pm\pm 3\%$ .
2. Pressure Transmitters/Transducer:
- a. Air-to-Air:
    - 1) Provide transducer having the following minimum performance for measuring duct static pressure for VFD control or measuring differential pressure across filter banks:
      - (a) Accuracy:  $\pm\pm 1.0\%$  FS
      - (b) Non-Linearity, BFSL:  $\pm\pm 0.96\%$  FS
      - (c) Hysteresis: 0.10% full scale
      - (d) Non-Repeatability: 0.05% full scale
      - (e) Thermal Effects (compensated range): 0°F to +150°F
      - (f) Maximum Line Pressure: 10 PSI
      - (g) Zero/Span Shift: 0.033%FS/°F
      - (h) Long Term Stability: 0.5%FS/1year
  - b. Provide transducer with the following minimum performance for measuring differential pressure across piezometer fan inlet airflow measuring stations:
    - 1) Unit shall come factory equipped with static tube attached.
    - 2) Unit shall include: (1) LCD shall display differential pressure on face of sensor enclosure over the entire operational range, and (2) IPCC-rated polycarbonate enclosure with short circuit proof outputs and reverse polarity protected inputs.
    - 3) Accuracy at 72°F:  $\pm\pm 0.25\%$  FS
    - 4) Stability:  $\pm\pm 0.25\%$  full scale per year
    - 5) Temperature Error: (1) Zero:  $\pm\pm 0.025\%$  full scale per °C, (2) Span: Maximum  $\pm\pm 0.03\%$  full scale per °C
    - 6) Environmental Operating Range: 32°F to 140°F.
    - 7) Overpressure: Proof: (1) 2 psi, (2) Burst: 3 psi
    - 8) Humidity: 0% to 95% RH non-condensing.
3. Room Pressure Monitor System:
- a. General:

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- 1) The room pressure monitor system shall include a room pressure monitor, remote pressure sensor, door switch, keyed switch, and low voltage control transformer.
  - 2) The system shall continuously measure, display, and monitor the room pressure.
  - 3) All components of the room pressure monitor system shall be completely designed, tested, cataloged, and coordinated for single point responsibility.
  - 4) TCC shall furnish and install all wiring as required to connect system components.
- b. Room Pressure Monitor:
- 1) Shall measure and display room pressure and provide access to menu driven programming options via a keypad. Refer to drawings for room pressure monitor requirements.
  - 2) A minimum of two indicator lights shall be provided on the front of the monitor to indicate ALARM and NORMAL conditions.
  - 3) There shall be an alphanumeric digital display indicating the measured room pressure in inches of H<sub>2</sub>O with a display accuracy of 0.001 and shall be updated every second.
  - 4) There shall be low and high pressure audible alarms. Each alarm shall have a unique setpoint.
  - 5) The room pressure monitor shall not be capable of changing the room mode without the use of a password or keyed switch.
  - 6) The room pressure monitor shall accept an input from the door switch to silence the alarm.
  - 7) The room pressure monitor shall accept an input from the FMCS system to change the room mode as indicated in the control sequences.
  - 8) Provide the following inputs/outputs to the FMCS system:
    - (a) Pressure (analog).
    - (b) Room Mode (binary).
    - (c) Alarm (binary).
- c. Pressure Sensor:
- 1) Shall be temperature compensated over a range of 55°F to 95°F.
  - 2) The assembly shall not compromise the fire rating of the wall.
  - 3) Shall measure room pressure from -0.20000 to +0.20000 inches H<sub>2</sub>O with an accuracy of  $\pm\pm 0.001$  inches H<sub>2</sub>O.

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- 4) Shall be bidirectional to determine the proper direction of pressure. Unidirectional sensors are not acceptable.
  - 5) Manufacturer shall provide cable between the pressure sensor and room pressure monitor.
- d. Door Switch:
- 1) Magnetic door switch designed to interface with room pressure monitor.
- e. Transformer:
- 1) The transformer shall have a primary-side voltage of 120 VAC and a secondary-side voltage of 24 VAC.
  - 2) The transformer shall be UL and CSA listed.
  - 3) Manufacturer shall provide cable between the transformer and room pressure monitor.
- f. Keyed Switch:
- 1) Two-position rotating cam-type with key removable in both positions. Rated for 20A at 120V UL listed. Back and side wired. Provide key and stainless steel coverplate in a single gang electrical rough-in box. Provide black laminated three-layer phenolic nameplate with engraved white, 1/4" minimum letters for labels.
  - 2) Provide with spare keys.
- g. Room Pressure Indicator:
- 1) General:
    - (a) The room pressure monitor system shall include a room pressure monitor, pressure sensor, and low voltage control transformer.
    - (b) The system shall continuously measure, display, and monitor the room pressure.
    - (c) All components of the room pressure indicator shall be completely designed, tested, cataloged, and coordinated for single point responsibility.
    - (d) Display shall be visual color indicator with pressure readout.
    - (e) TCC shall furnish and install all wiring as required to connect system components.
  - 2) Room Pressure Monitor:
    - (a) Shall measure and display room pressure. Refer to drawings for room pressure monitor locations.
    - (b) A minimum of two indicator colors shall be provided on the front of the monitor to indicate ALARM (red) and NORMAL (green) conditions.
    - (c) There shall be an alphanumeric digital display indicating the measured room pressure in inches of H<sub>2</sub>O with a display accuracy of 0.001 and shall be updated

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every second.

(d) Provide the following inputs/outputs to the FMCS system:

(1) Pressure (analog).

3) Pressure Sensor:

(a) Shall be temperature compensated over a range of 55°F to 95°F.

(b) The assembly shall not compromise the fire rating of the wall.

(c) Shall measure room pressure from -0.20000 to +0.20000 inches H2O with an accuracy of  $\pm\pm$  0.001 inches H2O.

(d) Shall be bidirectional to determine the proper direction of pressure. Unidirectional sensors are not acceptable.

(e) Manufacturer shall provide cable between the pressure sensor and room pressure monitor.

4) Transformer:

(a) The transformer shall have a primary-side voltage of 120 VAC and a secondary-side voltage of 24 VAC.

(b) The transformer shall be UL and CSA listed.

(c) Manufacturer shall provide cable between the transformer and room pressure monitor.

E. Current Measuring Devices:

1. Current Switches for Constant Speed Motors:

a. Digital device rated for amperage load of motor or device with split core design, adjustable high and low trip points, 600 VAC rms isolation, induced power from the monitored load, LED indicator lamps for output status and sensor power. The device shall sense overloading, belt-loss, and power failure with a single signal.

2. Current Switches for Motors Controlled by VFD:

a. Digital device rated for amperage load of motor or device with split core design, factory programmed to detect motor undercurrent conditions on variable or constant volume loads, self-calibrating, positive status indication, LED indicator lamps, 600 VAC rms isolation, induced power from the monitored load with NO output. The current sensor shall store the motor current operating parameters in non-volatile memory and have a pushbutton reset to clear the memory if the operating parameters change or the sensor is moved to another load. The device shall sense overloading, belt-loss, and power failure with a single signal. The sensor shall be mounted on the load side of variable frequency drives.

F. Occupancy Sensors:

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1. Use auxiliary contacts on sensor provided and installed by the Electrical Contractor. Refer to electrical drawings for sensor location and specifications. Coordinate with Electrical Contractor.
  2. Ceiling mounted[, dual technology: sonic and] passive infrared, 360° coverage pattern, zero crossing circuitry, adjustable sensitivity and time delay (initial setting: Time delay - 5 minutes unless noted otherwise below, integral isolated relay with normally open and normally closed outputs, LED indicator, five-year warranty, UL listed. TCC shall submit manufacturer supplied sensor layout drawing for shop drawing review. Provide full room coverage as recommended by manufacturer.
  3. Space Occupancy Initial Setting Schedule
  4. Initial Time
  5. Space Delay Setting
- G. Carbon Monoxide Sensors:
1. Solid-state gas sensor/transmitter, NEMA 1 or NEMA 4X gasketed enclosure, normal operating temperature 0-120°F, normal relative humidity operation 5-95%,  $\pm 5\%$  accuracy, and detection range of 0-200 ppm.
  2. Provide 4-20 mA output from the sensor to the FMCS system.
  3. Provide local alarm whenever carbon monoxide level exceeds 100 ppm.
  4. It shall be compatible with BACnet or LonWorks network interface and shall input these values to the network area controller.
  5. Install in accordance with OSHA requirements.
  6. Unit shall be factory calibrated and shall be re-calibrated after installation per manufacturer's recommendations.
- H. Combination Carbon Monoxide/Nitrogen Dioxide Sensors:
1. Solid-state gas sensor/transmitter for each gas, NEMA 1 or NEMA 4X gasketed enclosure, normal operating temperature 0-120°F, normal relative humidity operation 5-95%,  $\pm 5\%$  accuracy, and detection range of 0-200 ppm.
  2. Provide separate 4-20 mA output from the sensor to the FMCS system for each gas.
  3. Provide local alarm whenever carbon monoxide level exceeds 100 ppm or nitrogen dioxide level exceeds 5 ppm.
  4. It shall be compatible with BACnet or LonWorks network interface and shall input these values to the network area controller.
  5. Install in accordance with OSHA requirements.
  6. Unit shall be factory calibrated and shall be re-calibrated after installation per manufacturer's recommendations.

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### I. Carbon Dioxide Sensors:

1. Microprocessor based non-dispersive infrared sensor with range of 0 to 2,000 ppm CO<sub>2</sub> with  $\pm\pm$  100 ppm accuracy, maximum drift (compensated) of  $\pm\pm$  5% full scale in five years, VOC software and hardware sensing, duct mounting where applicable, 0-10V dc or 4-20 mA output directly proportional to ppm, adjustable alarm limit, membrane filter, and terminal block. The diffusion gas chamber in the sensor shall incorporate a reflective light pipe or wave guide surrounded by a gas permeable membrane that prevents particulate contamination of the sensor. Unit shall have selectable IAQ mode with output signal and sum of CO<sub>2</sub> and VOC levels.

### J. Miscellaneous Devices:

#### 1. Application Specific Controller Power Supply:

- a. For use with terminal air box, fan coil unit, or .
- b. Provide multiple enclosures with the following accessories and components as required to provide 24VAC power to terminal air boxes, differential pressure monitors, damper actuators, valve actuators, and other components and devices as required.
- c. NEMA-1 steel enclosures (12"x12"x6") with separate high and low voltage compartments and separate access covers.
- d. Either one 300 VA power supply with three 100 VA Class 2 outputs, or one 500 VA power supply with five 100 VA Class 2 outputs.
- e. Primary side shall receive 480/277/240/120 input to 24 VAC ungrounded, isolated output on the secondary side.
- f. Each secondary output shall include a 4 amp breaker, on/off switch, and LED indicator. Terminal blocks shall accept 16-22 AWG wire.
- g. Acceptable Manufacturer:
  - 1) RIB Functional Devices Model MSH300A-LVC or PSH500A-LVC

#### 2. Control Relays:

- a. Form "C" contacts rated for the application with "push-to-test" contact transfer feature and an integral LED to indicate coil energization.
- b. Mount all relays and power supplies in a NEMA 1 or NEMA 12 enclosure beside the FMCS panel or controlled device and clearly label their functions.

#### 3. Thermostat and Sensor Enclosures:

- a. Clear plastic guard with lock. Wire guard with tamperproof screws. Setpoint shall be adjustable with cover in place. Fasten to wall separately from thermostat. Provide guards in all corridors, gymnasiums, locker rooms, toilet rooms, assembly halls and as noted on the drawings.
- b. Heavy Duty Enclosure:

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- 1) Perforated steel, tamperproof locking thermostat and control device enclosure.
  - 2) Box shall be nominally 8"x6"x2" deep or sized as required to fit devices to be enclosed.
  - 3) Perforated cover shall be 16 gauge steel with maximum 3/16" perforations on maximum 1/4" staggered centers for a 55% free area.
  - 4) Secure to wall from inside of box. Cover shall be secured by tamperproof screws to frame.
  - 5) Color shall match electrical devices. Verify color with the Electrical Contractor.
4. Twist Timers:
- a. Wall-mounted heavy duty, with rotary dial and face graduated in minutes or hours as noted. Unit shall fit behind standard "decorator" wall plate. Color of timer and face plate shall match remainder of project. Verify with Electrical Contractor. Provide wall plate and engraved plastic label indicating service.
  - b. Switch shall be rated for 20 amps at 125 volts (10 amps at 277 volts) and fit standard 2-1/2" deep electrical box.
  - c. Provide time cycle noted on the drawings or in the specifications; up to 12 hours.
  - d. Manufacturers:
    - 1) Paragon SWD Series
    - 2) Tork A500 Series
    - 3) Intermatic FD Series
    - 4) Marktime Series 93
5. Drain Pan Condensate Overflow Switch: Float with integral magnet overflow switch conforming to UL508. No standby power required.

### K. Outdoor Weather Station:

1. Outdoor rated ventilated plastic enclosure, off-white color, radiation shield including the following parameters.
2. Measured Parameters:
  - a. Temperature Sensor: Thermistor sensing element or resistance temperature device (RTD).
    - 1) Operating Range: -40°F to 140°F
    - 2) Accuracy:  $\pm\pm 0.54^\circ\text{F}$  at 68°F
  - b. Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service.
    - 1) Measurement Range: 0-100% RH

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2) Accuracy:

(a)  $\pm$

(b)  $|\pm$

3.

a. Dew Point Temperature in  $^{\circ}\text{F}$

b. Wet Bulb Temperature in  $^{\circ}\text{F}$

c. Enthalpy. Enthalpy sensor shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling.

L. Oxygen Deficiency Monitor:

1. Long-Life Zirconium Oxide Sensor: 10-year life expectancy.

2. Measurement Range: 0-25%.

3. Minimum Detection: 0.05% of oxygen.

4. Accuracy/Repeatability:  $\pm\pm$  0.1% of range or  $\pm\pm$  0.1% of oxygen, whichever is greater.

5. 90% full scale response times for specified range: 0-25% less than 12 seconds.

6. Backlit Digital Display: High resolution 3/4" digit LCD. Reads full scale from 00.0% to 25.0%.

7. Status LED: Indicates Power, Safe Operation, Alarm Conditions, and Loss of AC Power.

8. Alarms: Two (2) fully adjustable oxygen concentration alarms. Preset for OSHA standards. 20.0% Caution and 19.5% Danger. Dry contacts 3A. @24VDC/115VAC.

9. Danger Alarm: 95dB danger alarm preset for 19.5%.

10. Data Logger: Logs data for 15 days at 1 minute intervals, 30 days at 2 minute intervals, etc.

11. Analog Output Signal: Isolated 4-20mA.

12. Battery Backup: One (1) hour.

13. Power Requirements: 115VAC, less than 10 watts.

14. Operating Temperature Range:  $0^{\circ}\text{F}$  to  $130^{\circ}\text{F}$ .

15. Polycarbonate enclosure suitable for use in an MRI room; mounting: wall mount.

### 2.20 CONDUIT AND BOXES

A. Conduit and Boxes: Refer to Electrical Section 26 0533 for materials, sizing, and other requirements

B. Conduit and Box Identification (Color and Labeling):

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1. Refer to the Temperature Control Contractor notes located on the mechanical temperature controls cover sheet for raceway and box color requirements.
2. Refer to Electrical Section 26 0553 for raceway and box labeling requirements.

### 2.21 WIRE AND CABLE

- A. Wire and Cable: Refer to Electrical Section 26 0513 for wire and cable materials.
- B. Wire and Cable Color: Refer to the Temperature Control Contractor notes located on the temperature controls cover sheet for wire and cable color requirements.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.
- B. Install system and materials in accordance with manufacturer's instructions.
- C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.
- D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" if practical to allow inspection without using a ladder.
- E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed ADA mounting requirements.
- F. Provide valves over 3/4" size with position indicators and pilot positioners where sequenced with other controls.
- G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.
- H. After completion of installation, test and adjust control equipment.
- I. Check calibration of instruments. Recalibrate or replace.
- J. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section.
- K. All controls associated with the proper operation of air handling units, pumps, or other mechanical equipment served by emergency power shall be connected to the emergency power system. Control components shall be powered from the equipment branch. In no instance shall panel be connected to the life safety or critical branch of the emergency power system. Panels may be connected to a common 20 amp, 120 volt circuit provided the total load on the circuit does not exceed 16 amps.

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Circuit conductors shall be sized per the table below. All power connections to the control panels shall be performed by a licensed electrician at the cost of this Contractor. Submit circuit information (total amperage on circuit, conductors length, and panel) for control panels to the Architect/Engineer for approval.

Circuit Load (Amps)	Circuit Max Length	Feeder Size
≤ 5	≤ 200ft	2#12 & 1#12 ground in 3/4" conduit.
≤ 10	≤ 100ft	2#12 & 1#12 ground in 3/4" conduit.
≤ 16	≤ 75ft	2#12 & 1#12 ground in 3/4" conduit.
≤ 200	≤ 325ft	2#10 & 1#10 ground in 3/4" conduit.
≤ 100	≤ 160ft	2#10 & 1#10 ground in 3/4" conduit.
≤ 75	≤ 100ft	2#10 & 1#10 ground in 3/4" conduit.

- L. All hardware, software, equipment, accessories, wiring (power and sensor), piping, relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.
  - 1. Labels For Control Devices:
- M. Provide labels indicating service of all control devices in panels and other locations.
  - 1. Labels may be made with permanent marking pen in the control panels if clearly legible.
  - 2. Use engraved labels for items outside panel such as outside air thermostats.
  - 3. Labels are not required for room thermostats, damper actuators and other items where their function is obvious.

**3.2 GRAPHIC DISPLAY**

- A. Create a customized graphic for each piece of equipment indicated on the itemized points list.
- B. Components shall be arranged on graphic as installed in the field.
- C. Include each graphic point listed in the itemized points list using real time data.
- D. Provide a graphic representation of the following:
  - 1. Where there are multiple buildings, color code the campus map by the systems serving that building. The building graphic shall be linked to the graphic for that building's systems.
  - 2. Where there are multiple floors, provide color codes/designations for the areas served by each AHU and TAB by floor.
  - 3. Where multiple AHUs serve one floor, color code the areas served by each AHU. The area shall be linked to the graphic for that area's AHU.
  - 4. Provide an overall floor plan of each floor of the building color coded by zone linked to the TAB for that zone. The zone shall be linked to the graphic for that zone's TAB graphic.

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5. Show the location of each thermostat on the floor plan.
  6. Provide separate graphics showing the chilled and heating water system flow diagram. Show temperatures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.
  7. Provide a graphic showing the steam system flow diagram. Show pressures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.
- E. The FMCS shall include full graphic operator interface to display the following graphics as a minimum:
1. Home page to include a minimum of six critical points: Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW, etc.
  2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
  3. Detailed graphics for each mechanical system including AHUs, ERUs, EFs, chillers, and boilers, as a minimum.
  4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.
- F. The FMCS shall include individual graphical buttons to access the following data stored in PDF format:
1. Project control as-built documentation including all TCS drawings, diagrams and sequences of operation.
  2. TCS Bill of Material for each system, e.g. AHU, RTU, FCU, boiler, etc.
  3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.

### 3.3 CONDUIT AND BOXES INSTALLATION

- A. Conduit and Box Installation: Refer to Electrical Section 26 0533 for execution and installation.
- B. Conduit and Box Identification (color and labeling) installation. Refer to Electrical Section 26 0553 for raceway and box identification installation.
- C. Outlet Box Schedule: Thermostat/temperature sensor:
1. Dry Interior Locations: Provide 4" square galvanized steel with raised cover to fit flush with finished wall line. When located in concrete block walls, provide square edge title cover of sufficient depth to extend out to face of block or masonry boxes.
  2. Other Conditions: Refer to Electrical Section 26 0533 for requirements.

### 3.4 WIRE AND CABLE INSTALLATION

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- A. Wire and Cable Installation: Refer to Electrical Section 26 0513 for execution and installation.
- B. Field Quality Control:
  - 1. Inspect wire and cable for physical damage and proper connection.
  - 2. Torque test conductor connections and terminations to manufacturer's recommended values.
  - 3. Perform continuity test on all conductors.
  - 4. Protection of cable from foreign materials:
    - a. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
    - b. Overspray of paint on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.
- C. Installation Schedule:
  - 1. Conduit terminations to all devices installed in applications with rotating equipment, expansion/contraction or vibration shall be made with flexible metallic conduit, unless noted otherwise. Final terminations to exterior devices installed in damp or wet locations shall be made with liquidtight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be made with flexible conduit rated for the environment.

### 3.5 COMMISSIONING

- A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.
- B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation.

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- C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.
- D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

### 3.6 PREPARATION FOR BALANCING

- A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).
- B. Check the calibration and setpoints of all controllers.
- C. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
- D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum cfm.
- E. Verify the operation of all interlock systems.

### 3.7 TEST AND BALANCE COORDINATION

- A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
- B. The Contractor shall provide a minimum of four (4) hours training for the Balancing Contractor in the use of these tools.
- C. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process until the first 20 terminal units are balanced.
- D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

### 3.8 DEMONSTRATION AND ACCEPTANCE

- A. At completion of installation, provide two days minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

**END OF SECTION 23 0900**

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**SECTION 23 2123  
HVAC PUMPS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. All pumps except where integral with a manufactured piece of equipment.
- B. Pump controls where self-contained.

**1.2 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 23 0500.
- B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Submit motor data indicating compliance with Section 23 0513.
- D. Submit certification that pumps, accessories, and components will withstand seismic forces defined in Section 230550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

**PART 2 - PRODUCTS**

**2.1 PUMPS - GENERAL**

- A. Statically and dynamically balance rotating parts.
- B. Construction shall permit complete servicing without breaking piping or motor connections.
- C. Pumps shall operate at 1750 rpm unless specified otherwise.
- D. Pump connections shall be flanged, whenever available.

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- E. Heating pumps shall be suitable for 225°F water.
- F. Motors shall comply with Section 23 0513.
- G. Pump impellers shall not have smaller diameters than those scheduled. The inlet and discharge pipe sizes shall also meet or exceed the scheduled pump.
- H. Pumps specified in this section operating in clean water with a flow greater than 25 GPM and less than 459 feet head shall have a maximum Pump Energy Index (PEI) as scheduled on the drawings. In no case shall the PEI exceed 1.0.

### 2.2 IN-LINE PUMP

- A. Type: Centrifugal, single stage, close coupled in-line, back pullout design, suitable for horizontal or vertical operation.
- B. Casing: Cast iron, rated for greater of 125 psi or 1.5 times actual working discharge pressure, flanged suction and discharge with gauge ports.
- C. Impeller: Bronze or stainless steel, fully enclosed, dynamically balanced, keyed to shaft and secured with locknut.
- D. Shaft: Steel or stainless steel.
- E. Seals: Mechanical type with internal flushing rated for -20 to 225°F and comprised of Buna elastomer, carbon primary ring, and ceramic stationary ring.
- F. Seals: Mechanical type rated for -20 to 250°F with EPR or EPT bellows and seat gasket, carbon primary ring, and silicon-carbide stationary ring.
- G. Manufacturers:
  - 1. Bell & Gossett
  - 2. Taco
  - 3. Aurora
  - 4. Armstrong
  - 5. Grundfos/Peerless/PACO
  - 6. Patterson
  - 7. Weinman/Crane

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General Installation Requirements:
  - 1. Install all products per manufacturer's recommendations.

### HVAC Pumps - 23 2123

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2. Support piping adjacent to pumps so that no weight is carried by pump casings. Provide supports under elbows on 4" and larger pump suction and discharge pipes. Allow a minimum of 18" clearance for removal of suction diffuser.
  3. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
  4. Install on vibration isolators as scheduled on drawings.
- B. In-Line Pumps:
1. Support in-line pumps individually so there is no strain on the piping. Install with a minimum of five diameters of straight pipe on pump suction and discharge.
  2. Pump orientation shall be in accordance with the manufacturer<sup>TMTM</sup>s recommendations.

**END OF SECTION 23 2123**



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**SECTION 23 2300  
REFRIGERATION PIPING AND SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping and Pipe Fittings
- B. Moisture and Liquid Indicators
- C. Check Valves
- D. Pressure Relief Valves
- E. Filter-Driers
- F. Suction Filters
- G. Solenoid Valves
- H. Expansion Valves
- I. Receivers
- J. Suction Accumulators

**1.2 QUALITY ASSURANCE**

- A. Remanufactured specialties are not acceptable.

**1.3 REFERENCES**

- A. ANSI/ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.
- B. ANSI/ASME SEC 9 - Boilers and Pressure Vessels Code, Welding and Brazing Qualifications.
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASME B31.5 - Refrigeration Piping.
- E. ANSI/ASTM B32 - Solder Metal.
- F. ANSI/ASTM B88 - Seamless Copper Water Tube.
- G. ANSI/AWS A5.8 - Brazing Filler Metal.
- H. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store piping and specialties in shipping containers with labels in place.

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- B. Protect piping and specialties from entry of foreign material by leaving caps and plugs in place until installation.

### PART 2 - PRODUCTS

#### 2.1 PIPING

- A. Design Pressure: 450 psig.
  - 1. Maximum Design Temperature: 250°F.
- B. Piping - 4" and under; Brazed Joint:
  - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
  - 2. Joints: Brazed with silver solder.
  - 3. Fittings: Wrought copper solder joint, ANSI B16.22.
  - 4. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
- C. Piping - 1-3/8" and Under; Dual Concentric Crimp Mechanical Press Connection (Contractor's Option):
  - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.
  - 2. Joints: Dual concentric crimp band mechanical press connection.
  - 3. Fittings: Refrigerant Grade Copper in accordance with ASTM B75 or ASTM B743 with embedded HNBR O-ring.
  - 4. Manufacturers:
    - a. Rapid Locking System (RLS)
    - b. Conex Banninger
    - c. Parker Hannifin
    - d. MaxiPro ACR
    - e. Nibco ACR Press
- D. Piping - 1-3/8" and Under; Mechanically Attached, Axially Swaged Compression Connection (Contractor's Option):
  - 1. Tubing: Type ACR hard drawn seamless copper tube, ASTM B280. Sizes indicated are nominal designation.

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2. Joints: Mechanically attached connector, axially swaged compression connection.
3. Fittings: Refrigerant grade copper in accordance with ASTM B75 or ASTM B743. Brass body with two stabilization inserts in accordance with ASTM B15/B16M. Two steel rings in accordance with ASTM A108-13; anerobic adhesive sealant.
4. Manufacturers:
  - a. VULKAN Lokring

### 2.2 MOISTURE AND LIQUID INDICATORS

- A. UL listed, with copper, brass, or copper-plated steel body, flared or solder ends, extended fittings in units up to at least 1-1/8" to allow brazing without removing the cartridge, sight glass, color coded paper moisture indicator that is replaceable without breaking piping connections for units up to 1-1/8" size, and plastic cap; maximum working pressure of 500 psi, and maximum temperature of 200°F.
  1. Manufacturers:
    - a. Sporlan
    - b. Henry Valve Company
    - c. Alco Valve

### 2.3 VALVES

- A. BA-14: Refrigerant Ball Valve: 3/8" thru 3-1/8", 500 psi, -40°F to +300°F, full-port up to 2-1/8" size, blow-out proof, PTFE seals, brass ball with equalizing orifice, visible position indication, seal cap, extended copper connections, replaceable stem seals, compatible with all CFC, HCFC, and HFC refrigerants.
  1. Manufacturers:
    - a. Henry Valve Company
    - b. Superior Valve
    - c. Alco Valve

### 2.4 CHECK VALVES

- A. CK-10: 1/4" thru 3-5/8", 500 psi, globe or angle pattern, brazed, brass body, cleaned-dried-plugged and tagged at factory for refrigerant service.
  1. Manufacturers:
    - a. Henry Valve Company
    - b. Mueller
    - c. Wolf-Linde

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### 2.5 PRESSURE RELIEF VALVES

- A. RV-5: Straight Thru or Angle Type: Brass body and disc, Teflon seat, factory sealed and stamped with ASME UV and National Board Certification NB; selected to ANSI/ASHRAE 15.

### 2.6 FILTER-DRIERS

- A. Replaceable Cartridge Angle Type: ANSI/AHRI 710, UL listed, brass or epoxy-coated steel shell, molded desiccant high-water capacity filter core(s); maximum working pressure of 500 psi; maximum temperature of 275°F; maximum pressure drop of 3 psi with R410a or 1.5 psi with R134a at system flow rate.
- B. Permanent Straight Thru Type: ANSI/AHRI 710, UL listed, steel shell with molded desiccant filter core, maximum working pressure of 500 psi, maximum pressure drop of 3 psi with R410a or 1.5 psi with R134a at system flow rate.

### 2.7 SUCTION FILTERS

- A. Replaceable Cartridge Angle Type: UL listed for 500 psi up to 2-18" size, and 400 psi for larger sizes, steel shell that passes 1000-hour salt spray test with copper fittings, replaceable pleated filter element(s); maximum pressure drops of 3 psi with R410a or 2 psi with R134a at system flow rate, capable of accepting molded desiccant core for cleanup after compressor burnout, access valve in the removable end plate. Install with side refrigerant inlet.

### 2.8 SOLENOID VALVES

- A. Valve: AHRI 760; pilot operated; copper or brass body and internal parts; synthetic seat; stainless steel stem and plunger assembly; extended solder ends to permit installation without disassembly; maximum working pressure of 500 psi; normally closed. Maximum pressure drop at system flow of 5 psi for R410a and 3 psi for R134a.
- B. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, surge protector and color-coded lead wires, integral junction box, Class F temperature rated, ANSI/UL 429.

### 2.9 RECEIVERS

- A. All receivers shall have capacity to hold the entire refrigerant charge when 90% full at 90°F per ASHRAE 15-78.
- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 450 psi working pressure, with tappings for inlet, outlet, and relief valve or fusible plug.
- C. Over 6" Internal Diameter: ANSI/AHRI 495, welded steel; ASME U or UM stamped for 400 psi, with tappings for inlet, outlet and pressure relief valve.

### 2.10 SUCTION ACCUMULATORS

- A. All accumulators shall have capacity to hold 50% of the refrigerant charge when 90% full at 90°F per ASHRAE 15-78, pressure drop equivalent to under 0.5°F at peak capacity, a finish that survives a 500-hour salt spray test, vertical design with dip tube and screened oil inlet orifice, and a hot gas boil-

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out coil to evaporate liquid refrigerant.

- B. 6" and Smaller Internal Diameter: ANSI/AHRI 495, UL listed, steel or copper, brazed; 400 psi pressure rating, with tappings for inlet, outlet, and pressure relief valve or fusible plug.
- C. Over 6" Internal Diameter: ANSI/AHRI 495, welded steel, ASME U or UM stamped for 450 psi, with tappings for inlet, outlet and pressure relief valve.

### 2.11 EXPANSION COMPENSATION

- A. Assembly consisting of two flexible connectors, two copper flexible connectors, two 90° elbows, and a 180° return pipe. Unit shall be in the form of a pipe loop.
- B. Connectors shall have corrugated copper hose bodies with copper braided casings.
- C. Connectors shall be rated for 150 psi working pressure at 70°F.
- D. Sizes 2" and smaller shall have copper sweat ends.
- E. Connectors shall be suitable for 1/2" permanent misalignment.
- F. Manufacturer:
  - 1. Metraflex Type MLS

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

### 3.2 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.
- F. Group piping whenever practical at common elevations and locations. Slope piping 1% in direction of oil return.

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- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access doors for concealed valves and specialties.
- J. Where pipe support members are welded to structural building frame, brush clean, and apply zinc rich primer to welding.
- K. Insulate piping and equipment; per Section 23 0719 and Section 23 0716.
- L. Provide external equalizer piping on expansion valves, and locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Connect distributor to expansion valve outlet.
- M. Install flexible connectors parallel to the shafts of compressors.
- N. Fully charge system with refrigerant after testing.

### 3.3 PIPE ERECTION AND LAYING

- A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job immediately.
- B. All pipe, fittings, valves, equipment and accessories shall have factory applied identification sufficient to determine their conformance with specified requirements.
- C. Exercise care at all times to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.
- D. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
- E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings.
- F. Cut all pipe to exact measurement and install without springing or forcing.

### 3.4 APPLICATION

- A. Provide refrigerant charging valve connections.

### 3.5 JOINING OF PIPE

- A. Brazed Joints:
  - 1. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated

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surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.

2. Flux shall conform to ANSI/AWS A5.31.
3. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°F or greater than the melting temperature of the brazing filler metal, whichever is greater.

### B. Mechanical Press Connection:

1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
2. Examination: Upon delivery to the jobsite, examine copper tubing and fittings for debris, defects, incise marks (manufacturer's engraving on tube), holes, or cracks.
3. Fully insert tubing into the fitting and mark tubing.
4. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
5. Joint shall be pressed with a tool approved by the manufacturer.
6. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

### C. Axially Swaged Connection:

1. Brass axially swaged connectors shall be installed in accordance with the manufacturer's installation instructions.
2. Installers shall be trained by a certified Vulkan LOKRING trainer. Provide proof of certification upon request.

## 3.6 FIELD QUALITY CONTROL

- A. Test piping system with nitrogen at 300 psig for at least 8 hours without loss of pressure.
- B. Comply with ASHRAE Standard 147 for refrigerant system integrity testing.
- C. After pressure testing, evacuate all refrigerant piping to at least 28" of mercury for 24 hours without loss of vacuum. Ensure moisture does not enter the piping prior to and during the tests.

**END OF SECTION 23 2300**

**SECTION 23 3100  
DUCTWORK**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Galvanized Ductwork
- B. Carbon Steel Ductwork
- C. Ductwork Reinforcement
- D. Ductwork Sealants
- E. Rectangular Ductwork
- F. Round and Flat Oval Ductwork
- G. Flexible Duct
- H. Grease Exhaust Duct
- I. Automotive Exhaust Duct
- J. Leakage Testing
- K. Ductwork Penetrations
- L. Painting

**1.2 REFERENCES: CONFORM TO ALL APPLICABLE REQUIREMENTS OF THE FOLLOWING PUBLICATIONS:**

- A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.
- B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ANSI/AWS A5.11M (1997) - Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding.
- D. ASHRAE - Handbook 2012 Systems and Equipment; Chapter 19 - Duct Construction.
- E. ASHRAE - Handbook 2017 Fundamentals; Chapter 21 - Duct Design.
- F. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
- G. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- H. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.



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- I. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- K. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- L. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
- M. ASTM E413-87 - Classification for Rating Sound Insulation.
- N. AWS A5.14M (1997) - Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods.
- O. AWS D9.1M/D9.1 - Sheet Metal Welding Code.
- P. IECC - International Energy Conservation Code (latest published edition)
- Q. NADCA ACR 2002 - Assessment, Cleaning, and Restoration of HVAC Systems.
- R. NADCA Standard 05 1997 - Requirements for the Installation of Service Openings in HVAC Systems.
- S. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- T. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.
- U. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Equipment.
- V. SMACNA - Air Duct Leakage Test Manual.
- W. SMACNA - HVAC Duct Construction Standards.
- X. SMACNA - Phenolic Duct Construction Standard 022.
- Y. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.
- Z. UL 181 - Factory-Made Air Ducts and Air Connectors.
- AA. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors
- BB. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.
- CC. UL 1978 - Standard for Grease Ducts.
- DD. UL 2221 - Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies.

### 1.3 DEFINITIONS

- A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.

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- B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.
- C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.
- D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

### 1.4 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 230500 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.
- B. Duct drawings shall be at 1/4" minimum scale complete with the following information:
  - 1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
  - 2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
  - 3. Location and size of all duct access doors.
  - 4. Room names and numbers, ceiling types, and ceiling heights.
  - 5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
  - 6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

## PART 2 - PRODUCTS

### 2.1 SHAPE

- A. Rectangular Duct - Single Wall:
  - 1. General Requirements:
    - a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
    - b. Transitions shall not exceed the angles in Figure 4-7.
  - 2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

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- a. All ducts shall be cross-broken or beaded.
- b. Snap lock seams are not permitted.
- c. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:
  - 1) Type 1:
    - (a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
    - (b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.
  - 2) Type 2:
    - (a) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
    - (b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
  - 3) Type 3 (acoustical - where acoustical lagging is located or as noted on drawings):
    - (a) Description: Same as Type 2, except filled with fiberglass and with slotted or perforated inner curve. Minimum insertion loss of 9 dB at 250 Hz and 6 dB at 1 KHz.
    - (b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.
  - 4) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
  - 5) Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
  - 6) Omitting every other vane is prohibited.
- d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
- e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.

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- f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
- g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
- h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
- i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
- j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
- k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
  - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
  - 2) Manufacturers:
    - (a) Ductmate Industries - 25/35/45
    - (b) Nexus
    - (c) Mez
    - (d) WDCI
    - (e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.
- l. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.
  - 1) Apply sealant to all inside corners. Holes at corners are not acceptable.
  - 2) Flanges shall be 24-gauge minimum (not 26 gauge).
  - 3) Manufacturers:
    - (a) Lockformer TDC

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- (b) TDF
- (c) United McGill
- (d) Sheet Metal Connectors
- (e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

### B. Round and Flat Oval Spiral Seam Ductwork - Single Wall:

1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
2. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
3. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
4. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
5. Ductwork shall be suitable for velocities up to 5,000 fpm.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
9. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
10. Transverse Joint Connections:
  - a. Crimped joints are not permitted.
  - b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
  - c. Ducts and fittings larger than 36" shall have flanged connections.
  - d. Secure all joints with at least 3 sheet metal screws before sealing.

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- e. Manufacturers, Slide-on Flanges:
  - 1) Ductmate Industries - SpiralMate
  - 2) Accuflange
  - 3) Sheet Metal Connectors are acceptable.
- f. Manufacturers, Self-Sealing Duct Systems:
  - 1) Lindab
  - 2) Ward "Keating Coupling"

### C. Round Snap-Lock Seam Ductwork - Single Wall:

1. Factory sealed snap-lock pipe. Transverse and longitudinal seams shall contain factory-applied self-sealing EPDM and co-polymer gasket. Snap-lock shall conform to SMACNA RL-8. Duct and gasket material shall meet the flame/smoke spread rating of 25/50 per ASTM-E84.
2. G-60 galvanized coating meeting ASTM A653 and ASTM A90 G-90 galvanized steel aluminum meeting ASTM B209 Alloy 3003 Temper H14 304 stainless steel meeting ASTM A480 2B Finish.
3. Snap-lock seams are only permitted on systems between -1"w.c. and 2"w.c. pressure class.
4. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
5. Duct and fittings shall meet the required minimum gauges listed in Chapter 3 of the SMACNA requirements for the specified pressure class.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Manufacturers:
  - a. GreenSeam Industries.

## 2.2 MATERIAL AND APPLICATION SPECIFIC

### A. Galvanized Steel:

1. General Requirements:
  - a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
  - b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.

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- c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
- d. Ductwork reinforcement shall be of galvanized steel.

### 2. Duct Hangers and Support:

- a. Ductwork supports shall be of galvanized or painted steel.
- b. All fasteners shall be galvanized or cadmium plated.
- c. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel attached to the bottom of ducts with spacing as required by SMACNA.
- d. Cable Hangers:
  - 1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.  
Manufacturers; Supports:
    - (a) Gripple
    - (b) Ductmate
    - (c) Duro Dyne
    - (d) Architect/Engineer approved
  - 2) Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. 8'-0" OC and as required by CMC/UMC and SMACNA guidelines.
- e. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer<sup>TM</sup>s ratings and instructions.
  - 1) Manufacturers; Supports:
    - (a) EZ Hanger

### B. Carbon Steel Ductwork:

- 1. Ductwork shall be black carbon steel. Refer to Grease Exhaust Duct below for thicknesses.

### C. Grease Exhaust Duct:

- 1. Field Fabricated
  - a. All ductwork shall be 16 gauge minimum, Type 304L stainless steel. Concealed ductwork may be 16 gauge black steel.

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- b. Concealed Ductwork:
  - 1) Range hood/grease exhaust ducts having an area of 4 sf or less shall be 16 gauge carbon steel.
  - 2) Range hood/Grease exhaust ducts having an area greater than 4 sf shall be 14 gauge carbon steel.
- c. All joints and fittings shall be continuously welded and liquid-tight.
- d. Exposed ductwork shall have a #3 finish. Concealed ductwork may have a mill finish.
- e. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- f. Provide pre-fabricated access doors and labels required by NFPA 96 on sides of duct at least 1.5" from bottom. Provide access at each change in direction and at maximum 20-foot intervals in horizontal ducts. Provide access at every floor for vertical ducts.
- g. Install grease traps in kitchen grease and dishwasher ducts at base of all vertical risers and low points in the system.
- h. Where grease ducts are 20" x 20" or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
- i. Install ducts with proper clearance to combustible and limited-combustible materials.
- j. Grease ducts installed with volume dampers shall conform to the damper specified in ductwork accessories.
- k. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.
  - 1) Manufacturer, Duct Doors:
    - (a) Ductmate Industries "Ultimate I" or "Ultimate II" Style door
    - (b) Approved equal
  - l. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
  - m. Refer to Section 230713 for duct insulation material and insulated access door when required to provide proper enclosure of ductwork.
- 2. Prefabricated System (Round):
  - a. Inner Liner: 0.035" Type 304 stainless steel.
  - b. Outer Liner: 0.025" aluminized steel.



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- c. Insulation: 4" annular space between inner and outer walls shall be filled with 4" of high temperature ceramic fiber insulation.
- d. Seal ductwork liquid-tight by mechanical joint consisting of integral flanges, with stainless steel flange band and sealed with type P080 sealant.
- e. Ductwork shall include hood and fan transitions, cleanout ports, fire suppression and washdown nozzles, expansion joints, and other ductwork provided by manufacturer to ensure completely rated system.
- f. Ductwork shall require zero clearance to combustibles. Seal and/or firestop ductwork through non-rated and up to two hour rated penetrations. Firestop with ductwork manufacturer approved materials.
- g. Provide all duct access doors and labels required by NFPA 96. Provide access at each change in direction and at maximum 12-foot intervals.
- h. Where grease ducts are 20" diameter or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
- i. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- j. Anchor duct with manufacturer approved materials of a minimum 5/8" diameter.
- k. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.
  - 1) Manufacturer, Duct Doors:
    - (a) Ductmate Industries "Ultimate Round" style door
    - (b) Approved equal
  - l. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
- m. Ductwork shall be rated for continuous operation at 500°F and intermittently at 2000°F.
- n. System shall be listed as a 2-hour fire rated shaft enclosure per UL 2221.
- o. Manufacturers:
  - 1) Metal-Fab No Chase
  - 2) Schebler
  - 3) Security Chimneys
- 3. Prefabricated System (Rectangular):
  - a. Inner Liner: 0.035" Type 403 stainless steel.

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- b. Outer Liner:
  - 1) 36" or less maximum duct dimension: 0.025" aluminized steel.
  - 2) Greater than 36" maximum duct dimension: 0.035" aluminized steel.
- c. Insulation: 3" annular space between inner and outer walls shall be filled with 3" of high temperature ceramic fiber insulation.
- d. Maximum duct dimension ratio: 6:1.
- e. Seal ductwork liquidtight by mechanical joint consisting of integral flanges, with stainless steel flange band and sealed with PN 101087A sealant.
- f. Ductwork shall include hood and fan transitions, cleanout ports, fire suppression and washdown nozzles, expansion joints, and other ductwork provided by manufacturer to ensure completely rated system.
- g. Ductwork shall require zero clearance to combustibles. Seal and/or firestop ductwork through non-rated and up to two hour rated penetrations. Firestop with ductwork manufacturer approved materials.
- h. Provide all duct access doors and labels required by NFPA 96. Provide access at each change in direction and at maximum 12-foot intervals.
- i. Where grease ducts are 20" maximum side dimension or larger, install access for personnel to enter duct. Duct supports must be sized to support the duct weight and an additional 800 lbs per NFPA 96.
- j. Do not penetrate fire rated partitions, unless protected as required by applicable codes.
- k. Anchor duct with manufacturer approved materials of a minimum 5/8" diameter.
- l. Grease exhaust duct doors shall be grease and airtight, UL 1978 listed, meet NFPA 96 standards, and all mechanical codes. Grease duct access doors can be sandwich type or with a weld-on frame, with/without hinge.
  - 1) Manufacturer, Duct Doors:
    - (a) Ductmate Industries "Ultimate Round" style door
    - (b) Approved equal
- m. All grease duct access doors used must be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.
- n. Ductwork shall be rated for continuous operation at 500°F and intermittently at 2000°F.
- o. System shall be listed as a 2-hour fire rated shaft enclosure per UL 2221.
- p. Manufacturers:

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1) Van Packer GRZ

### D. Automotive Exhaust Duct:

#### 1. Sheet Metal:

- a. Ductwork shall be spiral seam single wall type. Construct to requirements of SMACNA Class I Industrial Duct with a pressure rating of 7" negative.
- b. Do not penetrate fire rated partitions, unless protected as required by applicable codes.

#### 2. Tubing/Flex Hoses:

- a. Flexible ducts shall be high temperature fiberglass with wire reinforcing.
- b. Provide hose reels, lifting elbows, support cables, winches, tailpipe adaptors, and all other required accessories as shown on the drawings.

#### c. Manufacturers, Tubing:

- 1) DSP Monoxivent
- 2) Car-Mon Products, Inc.
- 3) Engwald
- 4) National
- 5) Nederman
- 6) Car-mon

## 2.3 DUCTWORK REINFORCEMENT

- A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.
  1. Ducts must be over 18" wide.
  2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
  3. Tie rods must not exceed 1/2" diameter.
  4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

## 2.4 DUCTWORK SEALANTS

- A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed

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ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

- B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.
- C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.
- D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
  - 1. LEED v4 - Low Emitting Materials - Adhesives and Sealants.
  - 2. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
  - 3. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
  - 4. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.
- E. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F.
  - 1. Manufacturers, Pressure-Sensitive Tape:
    - a. Venture Tape 1581A
    - b. Compac #340
    - c. Scotch Foil Tape 3326
    - d. Polyken 339

### 2.5 FLEXIBLE DUCT

- A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.
- B. Flame Spread/Smoke Developed: Not over 25/50.

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- C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.
- D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.
- E. Standard:
  - 1. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.
  - 2. Flexible duct shall have polymer wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2" thick, 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of polyester film laminated to glass mesh. Usage: MRI rooms.
  - 3. Inner liner shall be airtight and suitable for 6" WC static pressure through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft<sup>2</sup>\*°F\*hr/Btuh. Temperature range of at least 0-180°F. Maximum velocity of 4,000 fpm.
  - 4. Usage:
    - a. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
    - b. Connections to air inlets and outlets. Do not exceed 5'-0" in length.
- F. Acoustic:
  - 1. Flexible duct shall be acoustic rated in accordance with ASTM E477 and ADC Test Code FD 72-RI by ETL. Insertion loss values noted below are for flow velocities less than 2,500 fpm. Submittals shall include insertion losses ratings per sizes and lengths listed below regardless of sizes shown on the drawings.
  - 2. Flexible have corrosion-resistant wire helix, bonded to a nylon fabric core inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.
  - 3. Inner liner shall be airtight and suitable for 6" WC static pressure through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft<sup>2</sup>\*°F\*hr/Btuh. Temperature range of at least 0-180°F. Maximum velocity of 4,000 fpm.
  - 4. Minimum Acoustic Insertion Losses per octave band:
    - a. Straight Duct:

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- b. 90deg Elbow:
- 5. Usage:
  - a. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
  - b. Connections to air inlets and outlets. Do not exceed 5'-0" in length.
  - c. Acceptable Manufacturers:
    - 1) Flexmaster USA - Type 6
    - 2) Thermaflex M-Ke
- G. Radius Forming Elbows:
  - 1. Flexible plastic radius forming elbow for use with flexible ducts to create 90deg elbow. One size for 6" to 16" diameter ducts. UL listed for return plenum spaces.
  - 2. Usage: All supply air terminals with flexible ductwork connection.
  - 3. Installation: Attach to flex duct and secure draw bands without crushing flex duct to form smooth radius elbow. Suspend radius forming elbow to structure. Install per manufacturer's instructions.
  - 4. Acceptable Manufacturers:
    - a. Hart & Cooley - Smartflow
    - b. Thermaflex - Flexflow
    - c. Titus - Flexright

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Provide openings in ducts for thermometers and controllers.
- B. Locate ducts with space around equipment for normal operation and maintenance.
- C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.
- D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.
- E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.
- F. Repair all duct insulation and liner tears.

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- G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.
- H. Insulate terminal air box reheat coils. Seal insulation tight to form a tight vapor barrier.
- I. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.
- J. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.
- K. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 230550 for seismic requirements.
- L. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
- M. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

### 3.2 DUCTWORK SEALING

#### A. General Requirements:

- 1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
  - 2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
  - 3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
  - 4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.
- B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.
- C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

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### 3.3 TESTING

- A. Interior Duct - Less than 3" WG (positive or negative):
1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
  2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
  3. Seal ducts to bring the air leakage into compliance.
  4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- B. Interior Duct - 3" WG and Above (positive or negative):
1. A minimum of 25% of interior ductwork (inside the building envelope) shall be tested. The Owner or designated representative shall select the sections to be tested. If duct has outside wrap, testing shall be done before it is applied.
  2. Duct system shall be completely pressure tested. If duct has outside wrap, testing shall be done before it is applied.
  3. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
  4. Seal ducts to bring the air leakage into compliance.
  5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- C. Exterior Duct - 1/2" WG and Above (positive or negative):
1. All exterior ductwork (outside the building envelope) shall be completely pressure tested. If duct has outside wrap, testing shall be done before it is applied.
  2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
  3. Seal ducts to bring the air leakage into compliance.
  4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.
- D. Test Procedure:
1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:
    - a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.



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- b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
- c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
- d. All joints shall be felt by hand, and all discernible leaks shall be sealed.
- e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
- f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
- g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
- h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
- i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

### E. Grease Exhaust Duct:

- 1. A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of ductwork to be tested. The lamp shall be open to emit light equally in all four directions.
- 2. Testing of the entire exhaust duct system including the hood-to-duct connection shall be performed. Ductwork shall be permitted to be tested in sections provided every joint is tested.
- 3. Leakage testing shall occur prior to use or concealment of the duct system. Ducts shall be considered concealed where installed in shafts or covered by insulation or wrap that prevents ductwork from being visibly inspected on all sides. The test shall be performed in the presence of the code official.

### 3.4 DUCTWORK PENETRATIONS

- A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.
- B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.
- C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

### 3.5 PAINTING

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- A. Paint interior of ducts black within twice the largest duct dimension of inlets and outlets where interior of duct is visible.
- B. Paint bottom of ducts black within twice the largest duct dimension where a duct is routed above an unducted perforated grille and the duct is visible.

**END OF SECTION 23 3100**

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**SECTION 23 3300  
DUCTWORK ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Manual Volume Dampers.
- B. Fire Dampers.
- C. Backdraft Dampers.
- D. Drip Pans.
- E. Duct Access Doors.
- F. Duct Access Sleeve.
- G. Duct Test Holes.
- H. Remote Volume Control Devices.
- I. Temperature Control Dampers.

**1.2 REFERENCES**

- A. ASTM E477-06a - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- B. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- C. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
- D. SMACNA - HVAC Duct Construction Standards - Third Edition - 2005.
- E. UL 33 - Heat Responsive Links for Fire-Protection Service.
- F. UL 555 - Fire Dampers and Ceiling Dampers.

**PART 2 - PRODUCTS**

**2.1 MANUAL VOLUME DAMPERS**

- A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.
- B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.
- C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.

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- E. Provide locking quadrant regulators on single and multi-blade dampers.
- F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

### 2.2 DYNAMIC CURTAIN BLADE FIRE DAMPERS (FD)

- A. Furnish and install fire dampers in ducts, where shown on the drawings, at the point where they pass through a fire wall or a floor and in all other locations required by the local fire department, The National Fire Protection Association's Pamphlet No. 90A and all other applicable codes.
- B. Fire dampers shall be UL 555 listed for 1-1/2-hour fire resistance unless noted otherwise, dynamic rated with heated airflow at 2,000 fpm and 4" WC, and have all blades stacked out of the airstream (Type B).
- C. Where dampers are in aluminum or stainless steel duct, provide stainless steel dampers.
- D. Fire dampers shall be held open by a fusible link rated at 165°F unless otherwise called for on the drawings or by local codes.
- E. Dampers shall be installed in sleeves of sufficient thickness to comply with the UL555 Standard for Safety Fire Dampers listing of the damper. Where UL555 permits sleeve thickness to be the same as that of the duct gauge, such thickness shall not be less than that specified in NFPA 90A for breakaway style sleeves. If a breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gauge for dampers up to 36" wide by 24" high and 14 gauge for dampers exceeding 36" wide by 24" high. Damper sleeve shall not extend more than 6" beyond the firewall or partition unless damper is equipped with a factory installed access door. Sleeve may extend up to 16" beyond the firewall or partition on sides equipped with the factory installed access door.
- F. Maximum Curtain Damper Size (Multi-section) at less than 2,000 fpm:
  - 1. Vertical Installation: 72"w x 48"h or 48"w x 72"h or 120"w x 24"h.
  - 2. Horizontal Installation: 36"w x 48"h or 48"w x 36"h.
- G. Maximum Curtain Damper Size at greater than 2,000 fpm: Vertical or horizontal - 24"w x 24"h.
- H. Locate access door in the ductwork for visual inspection and on the latch side to replace link easily. Each access door shall have a label with letters at least 1/2" high, reading "FIRE DAMPER".

### 2.3 DYNAMIC MULTIPLE BLADE FIRE DAMPERS (FD)

- A. General:
  - 1. Furnish and install control/fire/smoke dampers in ducts, where shown on the drawings, at the point where they pass through a fire/smoke partition and in all other locations required by the local Fire Department, the National Fire Protection Association Pamphlet No. 90A, and all other applicable codes.

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2. Fire Resistance Rating: Assemblies shall be 1-1/2 hour rated under UL Standard 555 unless noted otherwise on drawings.
  3. Airflow Rating: Dynamic rated at 2,000 fpm and 4" WC.
  4. Temperature Rating: Assemblies shall be UL 555S listed for use in smoke control system with a 250°F temperature rating.
  5. Leakage Rating: Class II. Shall not leak over 20 cfm per square foot at 4" WC (Class II).
  6. Where dampers are in aluminum or stainless steel duct, provide stainless steel dampers.
- B. Construction:
1. Frame: 5 inches x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners.
  2. Sleeve: Dampers shall be installed in sleeves of sufficient thickness to comply with UL555 Standard for Safety Fire Dampers listing of the damper. Where UL555 permits sleeve thickness to be the same as that of the duct gauge, such thickness shall not be less than that specified in NFPA 90A for breakaway style sleeves. If a breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gauge for dampers up to 36" wide by 24" high and 14 gauge for dampers exceeding 36" wide by 24" high. Damper sleeve shall not extend more than 6" beyond the firewall or partition unless damper is equipped with an actuator or factory installed access door. Sleeve may extend up to 16" beyond the firewall or partition on sides equipped with the actuator or factory installed access door.
  3. Blades: Opposed blade; airfoil-shaped, single piece, minimum 14 gauge double skin. Galvanized steel. Maximum 6" damper blades.
  4. Seals: Blade seal shall be silicone fiberglass material to maintain smoke leakage rating to minimum of 450°F and galvanized steel for flame seal to 1,900°F. Seal to be mechanically attached to blade edge. Jam seal shall be stainless steel, flexible metal compression type.
  5. Bearings: Self-lubricating stainless-steel sleeve, in extruded hole in frame.
  6. Axle: Minimum 1/2" plated steel, hex shaped, mechanically attached to blade.
- C. Fusible Link: Fire dampers shall be held open by a fusible link rated at 165°F unless otherwise called for on the drawings or by local codes.
- D. Temperature Release Device: FSD shall contain a single 165°F heat sensor capable of remote override of fire-induced closure to permit reopenable operation in a dynamic smoke management system. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Wiring by Electrical Contractor.
- E. Maximum Multi-Blade Size (Multiple Section) at 2,000 fpm and 4" WC:
1. Vertical Installation: 120"w x 48"h or 64"w x 96"h.
  2. Horizontal Installation: 120"w x 48"h or 60"w x 96"h.

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- F. Access Door: Locate access door in the ductwork for visual inspection and on the latch side to replace link easily. Each access door shall have a label with letters at least 1/2" high, reading "FIRE DAMPER".

### 2.4 BACKDRAFT DAMPERS

- A. Gravity backdraft dampers, size 18 inches x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.
- B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90° stop, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
- C. Models:
  - 1. Ruskin CBD4
  - 2. Arrow 655
  - 3. Safe-Air/Dowco BRL
  - 4. Greenheck EM.

### 2.5 DRIP PANS

- A. Install drip pans under all rooftop exhaust fans, intake hoods, exhaust hoods and other roof penetrations that do not have ductwork below them to intercept dripping water.
- B. Drip pans shall be 22 gauge minimum cross-broken or reinforced sheet metal with 2" welded upturned lips.
- C. Pans shall extend 6" in all directions beyond the opening and shall have the top of the lip located 25% of the maximum throat dimension below the opening.
- D. Insulate interior of drip pan with 1" thick elastomeric foam insulation. Adhere foam to drip pan with standard foam adhesive.

### 2.6 DUCT ACCESS DOORS

- A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.
- C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
- D. Access doors with sheet metal screw fasteners are not acceptable.

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- E. Minimum size for access doors shall be 24" x 16" or full duct size, whichever is less.
- F. Provide duct access door in all horizontal return ductwork at 20 foot intervals per NFPA 90A.
- G. Fire Damper, Fire/Smoke Damper Access Provide quantity of access doors such that two hands can fit inside ductwork to manually reset fire dampers. For ducts larger than 12x12 , provide one access door. For ducts 12" x 12" and smaller, provide one access door on bottom and one on side.

### 2.7 DUCT ACCESS SLEEVE

- A. Material: Galvanized G-90 ASTM A527 Access Section. 26 gauge galvanized 12" long constructed with Pittsburgh lock seam. Access section shall be suitable for ductwork pressure class and manufactured to maintain 100 percent of ductwork free area with a clamping type draw latch.
- B. Leakage: Maximum of 1/2 CFM @ 2" W.G..
- C. Flange Connection: 18 gauge galvanized. Clamps: 20 gauge galvanized with zinc coated draw latch.
- D. Gasket: Neoprene gasket 3/16" x 1-1/4", gasket profile forms to the inside of the clamp and seals the outer edges of the access section 18 gauge flanges. Seal seams in accordance with SMACNA HVAC Duct Construction Standard "" Metal and Flexible.
- E. Insulation: Contractor shall insulate in field per Duct Insulation Schedule. Include removable wrap around flanges. Manufacturer shall provide duct liner in systems as defined in Duct Insulation Schedule.
- F. Locations: Install duct access sleeve in the following locations:
  - 1. Fire Dampers, Fire Smoke Dampers and Smoke Dampers: Provide duct access sleeve at dampers 12" x 12" and 12" diameter and smaller not more than 4" away from the fire damper sleeve.
  - 2. Insert
- G. Manufacturers:
  - 1. Langdon, Inc. Sure Clamp
  - 2. Insert

### 2.8 GREASE DUCT ACCESS DOORS

- A. Provide pre-fabricated and pre-insulated duct access doors by the same manufacturer as the fire resistive duct wrap.

### 2.9 DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

### 2.10 REMOTE VOLUME CONTROL DEVICES - MANUAL

#### Ductwork Accessories - 23 3300

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- A. Remote volume control balancing damper shall be supplied with either miter gears or right angle worm gears. Provide all damper shafts, gearboxes, couplings, U-joints, bearings, shafts, offsets, adapters, and adjustable concealed covers as required.
- B. When distances, angles, or offsets prevent installing solid rods, the mechanical cable control system may be utilized. Provide all damper shafts, rack and pinion gear operator, cables and sleeves, and adjustable ceiling mounting cups.
- C. Manufacturers:
  - 1. Young Regulator Company
  - 2. Metropolitan Air Technology
  - 3. Rototwist
  - 4. Dura Dyne

### 2.11 DUCTWORK ACCESSORY SEALANTS

- A. Ductwork accessory sealants and adhesives shall conform to Section 233100.
- B. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:
  - 1. LEED v4- Low Emitting Materials - Adhesives and Sealants.
  - 2. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
  - 3. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
  - 4. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

### 2.12 CONTROL DAMPERS AND DAMPER ACTUATORS

- A. Control dampers and damper actuators shall be furnished by the Temperature Control Contractor (Section 230900) and shall be installed by this Contractor.
- B. Coordinate exact sizes, locations, and installation requirements with the Temperature Control Contractor.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General Installation Requirements:

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1. Install accessories in accordance with manufacturer's instructions.
  2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
  3. Coordinate and install access doors provided by others.
  4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
  5. Provide duct test holes where indicated and as required for testing and balancing purposes.
- B. Manual Volume Damper:
1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
  2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.
  3. Grease duct volume dampers shall be continuously welded to duct and/or hoods so that system is liquidtight.
- C. Drain Pan:
1. Drain pans shall be installed per ASHRAE 62.1.
    - a. All drain pans shall be field tested under normal operating conditions to ensure proper drainage.
    - b. Field testing of drain pans is not required if units with factory installed drain pans have been certified (attested in writing) by the manufacturer for proper operation when installed as recommended.
- D. Control Dampers and Damper Actuators:
1. Install control dampers and damper actuators in accordance with manufacturer's instructions and in coordination with the Temperature Control Contractor.
  2. Seal around damper frame inside ductwork with duct sealant to prevent bypass around damper.
  3. Provide duct access door at each control damper.

**END OF SECTION 23 3300**

**Ductwork Accessories - 23 3300**

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**SECTION 23 3416  
CENTRIFUGAL FANS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. In-line Centrifugal Fans.
- B. Cabinet Fans.
- C. Performance Ratings: Bear the AMCA Certified Rating Seal - Air Performance.
- D. Sound Ratings: Bear the AMCA Certified Rating Seal - Sound and Air Performance.
- E. Fabrication: Conform to AMCA 99.

**1.2 REFERENCES**

- A. AMCA 99 - Standards Handbook.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- F. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- G. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- H. SMACNA - HVAC Duct Construction Standards, Current Edition.

**1.3 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point.
- B. Submit operation and maintenance data. Include instructions for lubrication, motor and drive replacement, and spare parts list.
- C. Piezometer Flow Coefficients: Submittals for fans shall clearly indicate the size and associated flow coefficient for each fan included in the submittal as it relates to the piezometric airflow measuring system. Provide instructions indicating how the flow coefficient can be used in calculating fan airflow using the fan manufacturer-provided empirically derived formulas for calculating airflow. Include recommended differential pressure controller "P range based on scheduled maximum airflows.

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- D. Submit certification that centrifugal fans, accessories, and components will withstand seismic forces defined in Section 23 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.
- F. Structural calculations performed, prepared and signed by a Structural Engineer registered in the State of Nevada.
- G. Utility Set Stack Design:
  - 1. Submit calculations for stack resistance to lateral forces in accordance with IBC 2018, 100 mph winds, Seismic Zone 4, I = 1.0. Refer to structural requirements for non-structural materials in Division 1 for further criteria.
  - 2. Live loads shall be in accordance with IBC.

### 1.4 EXTRA STOCK

- A. Provide one extra belt set for each fan unit.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

## PART 2 - PRODUCTS

### 2.1 IN-LINE CENTRIFUGAL FAN

- A. Galvanized steel construction with stainless steel or cadmium plated fasteners and galvanized steel belt guard.
- B. Backward inclined, non-overloading, all aluminum wheel and hub. Dynamically balanced.
- C. Cast iron, adjustable pitch sheaves. V-belt drive sized for 1.5 of maximum horsepower. Operating point near center of adjustment range.

### Centrifugal Fans - 23 3416

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- D. Screw adjustment belt tightener.
- E. Regreasable bearings rated for 40,000 hour B-10 life at specified operating point. Extend lubrication lines outside of housing.
- F. Steel mounting brackets suitable for any mounting position.
- G. Motor per the drawings and Section 23 0513. Minimum 1/3 HP motors for all fans.
- H. Factory installed and wired disconnect switch.
- I. Manufacturers:
  - 1. Jenco Fan
  - 2. Carnes
  - 3. Cook
  - 4. PennBarry
  - 5. Greenheck

### 2.2 CABINET FANS

- A. Housing:
  - 1. Heavy gauge steel reinforced and braced with steel angle framework.
  - 2. Cleaned, phosphatized and painted with enamel or constructed entirely of galvanized steel.
  - 3. Removable access panels for fan removal.
  - 4. Insulate fan section interior with 1" thick, 3/4 lb. density fiberglass.
  - 5. Insulated, corrosion-resistant drain pan under fan sections.
  - 6. Minimum 12" x 18" hinged access doors on both sides of fan housing.
- B. Fan:
  - 1. Double width, double inlet, forward curved centrifugal, dynamically balanced.
  - 2. Grease lubricated ball bearings, rated for 200,000 hours L-50 life at design operating conditions.
  - 3. Extend lubrication lines for all bearings to an easily accessible location.
  - 4. OSHA belt guards with openings for tachometer readings.
- C. Motors and Drives:
  - 1. Motor shall have slide rails, adjusting screws, anchor bolts and bedplates.
  - 2. Adjust motor mounting bracket for tightening belts.

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3. Open drip-proof motors with grease lubricated bearings, minimum 1/3 HP. Motors on variable frequency drives shall be VFD rated. Refer to Section 23 0513.
4. V-belt drives with adjustable pitch sheaves for units 20 HP and below, fixed sheaves for larger units. Contractor shall provide replacement sheaves and belts for air balancing of the unit.
5. Furnish factory mounted and wired disconnect switch, non-fusible type with thermal overload protection.
6. Manufacturer:
  - a. Greenheck
  - b. Cook
  - c. Aerovent.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

##### **A. General Installation Requirements:**

1. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
2. Install flexible connections between fan and ductwork. Install metal bands of connectors parallel with minimum 1" flex between ductwork and fan while running.
3. Provide safety screen where inlet or outlet is exposed. Screens shall meet OSHA regulations for size of openings.

**END OF SECTION 23 3416**

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**SECTION 23 3423  
POWER VENTILATORS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Roof Exhaust Fan.
- B. In-Line Cabinet Fan.

**1.2 QUALITY ASSURANCE**

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300.
- C. Fabrication: Conform to AMCA 99.
- D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.1.

**1.3 REFERENCES**

- A. AMCA 99 - Standards Handbook.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
- D. AMCA 230 - AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.
- E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- G. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- H. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- I. SMACNA - HVAC Duct Construction Standards, Current Edition.

**1.4 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).

**Power Ventilators - 23 3423**

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- B. Submit manufacturer's installation instructions.
- C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- D. Submit certification that power ventilators, accessories, and components will withstand seismic forces defined in Section 23 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### 1.5 EXTRA STOCK

- A. Provide one (1) extra belt set for each fan unit.

## PART 2 - PRODUCTS

### 2.1 ROOFTOP EXHAUST FAN - BELT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum hub and wheel with backward inclined blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. All steel parts galvanized or epoxy coated. Non-corrosive fasteners.
- E. V-belt drive with adjustable pitch drive sheave and adjustable motor mountings for belt tensioning.
- F. Motor mounted outside of air stream and ventilated with outside air. Motor not less than 1/3 HP.
- G. Aluminum or brass bird screen. Plastic mesh will not be allowed.

### Power Ventilators - 23 3423

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- H. Furnish factory mounted and wired disconnect switch: Non-fusible type with thermal overload protection mounted inside fan housing, factory wired through an aluminum conduit.
- I. Disconnect provided by Electrical Contractor.
- J. Furnish normally closed, electric motorized damper. Provide step down transformer if required. Install and wire damper to open when fan runs.
- K. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).
- L. Mill aluminum finish.
- M. Permanently lubricated, permanently sealed, self-aligning ball bearings.
- N. Manufacturers:
  - 1. Aerovent
  - 2. Greenheck
  - 3. Cook
  - 4. Carnes
  - 5. PennBarry
  - 6. ACME
  - 7. ILG
  - 8. Jenco
  - 9. Soler-Palau
  - 10. York
- O. Furnish permanently lubricated sealed ball type motor and drive shaft bearings sized for 200,000 hours life at specified operating conditions. Drives sized for 150% of rated motor horsepower. Drive assembly and wheel supported by vibration isolators.
- P. Manufacturers:
  - 1. Aerovent "FACX"
  - 2. Cook "ACE-B"
  - 3. Greenheck "GB"
  - 4. Carnes "VEB"
  - 5. PennBarry DX



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6. ACME PV
7. ILG CRB
8. Twin City BCRD
9. York

### 2.2 ROOFTOP EXHAUST FAN - DIRECT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum or composite with backward inclined or airfoil blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. All steel parts galvanized or epoxy coated. Non-corrosive fasteners.
- E. Direct drive, motor mounted outside of air stream and ventilated with outside air.
- F. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- G. Furnish factory mounted and wired disconnect switch: Non-fusible type with thermal overload protection mounted inside fan housing, factory wired through an aluminum conduit.
- H. Disconnect provided by Electrical Contractor.
- I. Furnish solid-state dial speed controller. Mount and wire inside fan unless shown otherwise on the drawings. Provide permanent marking at balanced point.
- J. Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs.
- K. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).
- L. Mill aluminum finish.
- M. Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by vibration isolators.
- N. Manufacturers:
  1. Aerovent "FACX"
  2. Cook "ACE-D"
  3. Greenheck
  4. ILG - CRD

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5. ACME PX
6. PennBarry DX
7. Carnes
8. Twin City DCRU
9. Jenco
10. Soler-Palau
11. York

### 2.3 ROOFTOP EXHAUST FAN - VERTICAL DISCHARGE - BELT DRIVEN

- A. Fan Wheel: Centrifugal type, aluminum hub and wheel with backwards inclined blades, statically and dynamically balanced.
- B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.
- C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
- D. V-belt drive with adjustable pitch drive sheave and adjustable motor mountings for belt tensioning.
- E. Motor mounted outside of air stream and ventilated with outside air. Motor not less than 1/3 HP.
- F. Aluminum or brass bird screen. Plastic mesh will not be allowed.
- G. Furnish factory mounted and wired disconnect switch: Non-fusible type with thermal overload protection mounted inside fan housing, factory wired through an aluminum conduit.
- H. Disconnect provided by Electrical Contractor.
- I. Permanently lubricated, permanently sealed, self-aligning ball bearings.
- J. Furnish permanently lubricated sealed ball type motor and drive shaft bearings sized for 200,000 hours life at specified operating conditions. Drives sized for 150% of rated motor horsepower. Drive assembly and wheel supported by vibration isolators.
- K. Include ventilated curb cap and hinged base with restraining means.
- L. Furnish normally closed, electric motorized damper. Furnish step down transformer if required. Install and wire damper to open when fan runs.
- M. All fans serving range hoods shall have extended shrouds to discharge at least 40" above roof and built-in grease trough with drain.
- N. Mill aluminum finish.
- O. Fan shall be UL listed for "Power Ventilators for Smoke Control Systems."

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P. Manufacturers:

1. ACME
2. Cook
3. Greenheck
4. PennBarry
5. Twin City
6. Jenco
7. Soler-Palau
8. York

### 2.4 ROOFTOP FAN CURBS

- A. Furnish and install prefabricated roof curbs for all rooftop fans.
- B. Size curb to match the curb cap of fan.
- C. Roof Mounting Curb: Curb height as shown on drawings, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.
- D. Unitized construction, continuous arc welded corner seams. Insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board. Damper support angle. Pressure treated wood nailer.
- E. If called for in the drawings, curbs shall be of the sound attenuation type. Sound attenuation curbs shall reduce the fan sone rating by at least 40% and not decrease fan cfm more than 8% (which is accounted for in the scheduled fan cfm). Baffles shall be removable for access to the dampers.
- F. 18-gauge galvanized steel construction.
- G. 14-gauge aluminum construction.
- H. Curb without cant.
- I. Manufacturers:
  1. Same manufacturer as the fan
  2. Pate
  3. RPS
  4. Thy

### 2.5 IN-LINE CABINET FAN

- A. Fiberglass lined, sheet metal housing, arranged for in-line installation.

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- B. Rubber torsion motor mounts.
- C. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for fractional horsepower induction motors, with thermal overload relay, toggle operator.
- D. Built-in backdraft damper.
- E. Centrifugal fan.
- F. Provide variable speed controller if shown on the drawings.
- G. Manufacturers:
  - 1. ACME
  - 2. Broan
  - 3. Carnes
  - 4. Cook
  - 5. Jenco
  - 6. PennBarry
  - 7. Greenheck
  - 8. Soler-Palau
  - 9. York

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated lag screws to roof curb.
- C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.
- D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

**END OF SECTION 23 3423**

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**SECTION 23 3501  
VEHICLE EXHAUST EXTRACTION RAIL SYSTEM**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES:**

- A. The following bid proposal includes all engineering specifications, installation, training, service and warranty for an Emergency Vehicle Exhaust Extraction System. Any deviations from this specification must be noted. Lowest priced equipment may not be approved if not considered to be equal and not in the best interest of the end user.
- B. The function of the vehicle exhaust removal system will be to source capture 100% of the exhaust emissions directly at the tail pipe of the vehicle and exhaust those emissions to a specified area safely outside the building.
- C. The exhaust system must not interfere with access to the vehicle, nor impede doorways/walkways/or exits that would endanger the welfare of fire personnel. Drooping loops of hose or the hose assembly touching the floor will not be permitted.
- D. As safety to personnel is of the utmost importance, the system shall be so designed as not to whip or fly back into quarters upon disconnection. Vehicles shall be capable of exiting quarters at normal speed without causing damage to the system or taking any portion of the hose or nozzle assembly along with the exiting vehicle.
- E. The fan shall automatically start prior to vehicle ignition.
- F. The exhaust system must move with the vehicle in a forward or reverse direction of travel and have an automatic release design without any positive locking device or air bladder that clamps or binds to the tail pipe. No system that uses the vehicles tailpipe, as a pulling force will be considered.
- G. The exhaust system shall utilize a minimum of 6.2" diameter hose in order to insure that the exhaust system can accommodate vehicle apparatus checks; and not limited to just emergency departures. Any smaller hose does not offer the required cross sectional area considered adequate for the volume of hot exhaust fumes discharged during extended run times required during routine vehicle check procedures.

**1.2 SCOPE OF WORK**

- A. A licensed and insured Contractor shall furnish and install a Source Capture Emergency Vehicle Exhaust Extraction System as designed and specified for the station(s).
- B. The Contractor shall provide and install a centrifugal exhaust fan with capacity for all connected vehicles and sized for expansion if specified.
- C. The Contractor shall provide and install an automatic fan start control console. The control console and all internal components shall be UL listed and manufactured in accordance with UL standard 508A and bear the UL label.
- D. The Contractor shall provide and install all ductwork.

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- E. The Contractor shall be responsible for the delivery, safe storage, and handling of the products and protect them from weather elements.

### 1.3 SYSTEM OPERATION

- A. The auto-disconnect exhaust system shall be a magnetic release type that captures 100% of the exhaust emissions directly from the tail pipe and discharges those emissions to a specific location by means of an exhaust fan. Upon emergency dispatch of the vehicle, the exhaust fan shall automatically start prior to the engine being energized. The exhaust fan shall remain in the "on" position for as long as any engine is running. Upon vehicle exit, the hose assembly remains connected to the tail pipe and automatically disconnects at a specified distance outside the door by the release of the magnet. The nozzle and hose assembly shall smoothly separate from the vehicle and safely retract to the stored position ready to connect to the vehicle upon reentry. Upon disconnection, the hose assembly shall not be permitted to swing wide or touch the floor, possibly endangering personnel or apparatus. The hose shall remain at the door, ready for reconnection.
- B. Once the apparatus has left the building, the fan will automatically shut down after a preset time interval.
- C. Upon return, the fan is automatically activated prior to vehicle entry and the nozzle is connected to the tail pipe in a standing position. Bending over to connect the exhaust system and expose the operator to harmful exhaust fumes is not permitted. No positive locking device or moving parts shall be permitted to be connected to the tail pipe. After the vehicle has been turned off, the fan can continue to operate for a preset time interval, normally two minutes.

### 1.4 SUBMITTALS AND CODES

- A. The following submittals and code compliance shall be required.
- B. Record building dimensions, note vehicle type and prepare shop drawings that include equipment position, dimensions, sizes, weights, performance data, and also location and size of field connections.
- C. Product Data: Provide manufacturer's literature and data sheets indicating rating capacities, dimensions, weights, accessories, and electrical requirements, wiring diagrams, location and size of field connections.
- D. Provide fan curves with specified operating point clearly plotted.
- E. Submit fan sound level data for fan specified.
- F. Manufacturer's Installation, Operation and Maintenance Manual, which outlines the procedures required for system installation, start up, operation and shut down. The instructions shall include the manufacturer's name, telephone number, model number, service manual number, parts list, and brief description of all equipment and the basic operating features. The maintenance instructions shall list routine maintenance procedures and troubleshooting guide.
- G. Certifications: International Quality System Standard ISO 9001 and ISO 14001 Certified. UL Certification: UL listing, 508A Industrial Control Panel bulletin. Compliance with: NFPA 1500, 2003 International Mechanical Code, NIOSH CIB #50, OSHA 2001 American Conference of Governmental Industrial Hygienists (ACGIH) 2002 Proposed Regulations for Benzene and Diesel Exhaust Fumes. Federal Communications Commission approvals.

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- H. Compliance with all State and Local mechanical, electrical and building codes: American Society of Manufacturing Engineers (ASME), National Electric Code (NEC), Uniform Building Code (UBC), American Institute of Steel Construction (AISC), Sheet Metal and Air Conditioning Contractors National Association (SMACNA), American Society of Testing Materials (ASTM).

### 1.5 QUALITY ASSURANCE

- A. All workmanship, manufacturing procedures, airflow design, and materials shall be tested and performance guaranteed.

### 1.6 EQUIPMENT WARRANTY

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from date of final acceptance of the complete job, against original defects of material and workmanship, or excessive wear or deterioration.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

- A. The equipment specified herein shall be a standard product of Nederman, Incorporated or approved equal.

### 2.2 SUCTION RAIL ASSEMBLY

- A. The Suction Rail shall be a polished aluminum extrusion that is formed in a configuration such that the extrusion serves not only as a suction duct, but also as the guide rail that the extraction trolley travels in. The wall thickness of the aluminum extrusion shall be no less than .09375". The weight of the aluminum extrusion is 4.6 lbs. per lineal foot. The area of the aluminum extrusion, in a cross-sectional view, shall have the minimum equivalent area of .2035 sq. ft. with an overall length as specified and indicated on the drawings. Each open end of the suction rail shall be covered with an end cap that can also be used as a round duct outlet for 6" diameter exhaust duct. As an alternate outlet, one or more rectangular-to-round transitions can be mounted on the topside of the suction rail after the cutout has been made per the manufacturer's specified size. A pair of EPDM rubber seals is installed at the bottom of the extrusion opening. The rubber seals have a Teflon strip on the inside surface which enables the trolley to travel smoothly and unhindered. The rubber seals close tightly during fan operation for an airtight seal, but open evenly around the trolley during trolley travel. The suction rail shall be supplied with internal rubber bumpers installed at both ends that serve as secondary stops to the trolley. The suction rail shall be supplied with suspension attachments that are specifically designed for fastening to the configuration of the suction rail. Spacing of the suspension attachments shall not exceed 16 feet center-to-center.

### 2.3 EXTRACTION TROLLEY ASSEMBLY

- A. The Extraction Trolley Assembly serves as the component in the Rail System that travels in the suction rail, carries and supports the vertical hose assembly, balancer, current collectors, shock absorber and trolley stop mechanism. The Extraction Trolley body shall be made of light weight composite with a low friction surface on each side to enable the trolley to travel smooth through the rubber seal.

### 2.4 BALANCER

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- A. Integrated to the Extraction Trolley Assembly is a Balancer. The adjustable tension Balancer shall retract the hose and nozzle away from the vehicle as it leaves the building and safely suspend the assembly off the floor in the storage position when not in use. The Balancer shall have a spring characteristics that ensure that the cord is wound onto the drum at a safe and constant speed.

### 2.5 VERTICAL HOSE

- A. The Upper Vertical Suction Hose shall be 6.2" in diameter, and of suitable flexibility to have a compression ratio of minimum 8:1. The lower hose shall be designed to withstand a 500oF engine temperature in conjunction with induced ambient air for cooling. The hose shall be capable of withstanding temperatures of 340 degrees Fahrenheit continuously, up to 370 degrees Fahrenheit on an intermittent usage basis. (NOTE: If a 'closed type sealed system' is being used, the temperature ratings must be 680°F and 740°F respectively.) The helix shall be external and made of aluminum. The helix shall have high flexibility and the fabric able to withstand oil, chemical, ozone and weather resistance.

### 2.6 NOZZLE

- A. The Nozzle shall be a minimum of 8" diameter and designed to capture 100% of the vehicle exhaust fumes generated at the vehicle tail pipe and is held in place by spring tension in conjunction with the magnet connection. The nozzle permits an ambient air mix in the air stream to immediately reduce exhaust emission temperatures up to 50% at the point of capture. The reduced air stream temperatures prolong component life by not permitting thermal breakdown of materials. The Nozzle shall be designed so as not to cause or create back pressure on any vehicle engine, nor draw raw diesel- or gasoline fumes into the exhaust hose while connected to a non-operating vehicle, nor create the possibility of spinning a non-lubricated turbo which could result in bearing failure.
- B. In a 'closed type sealed system', a pressurized container is created presenting an explosive potential when drawing raw fumes from a non-operating vehicle and all system electrical components must be of explosion proof design. No closed system will be considered.
- C. These conditions are non-existent with an ambient air mix nozzle design. The operator never has to touch the Nozzle for connection but can position the Nozzle over the tail pipe while the operator grips the hose handle and simultaneously connects the magnet to the anchor plate. Tension will be automatically applied to the Nozzle created by an internal leaf spring assembly, which holds the Nozzle firmly in place over the tail pipe. The positioning of the magnet on the vehicle, combined with the tension created at the Nozzle, shall not allow the Nozzle to come away from the tail pipe until the magnet is either automatically or manually de-energized. The Nozzle shall be constructed of both metal and rubber, with no internal movable parts related to the connection of the Nozzle to the tail pipe. The Nozzle Hose shall be a minimum of 6.2" in diameter. The hose material shall be lightweight coated fiberglass with a smooth bore. The galvanized steel helix shall be completely rubber covered. The inlet diameter at the Nozzle is oversized to allow maximum airflow capacity for large engines. The inlet boot of the Nozzle is to be made of EPDM rubber, and bonded to a sturdy 24 gauge steel conical reducer. The design of the nozzle shall allow for maximum flexibility to accept a variety of tail pipe configurations, which typically terminate at 90° to the side of the vehicle. Tail pipe adapters are not permitted nor required. No positive locking devices or a concept of a positive locking device, pneumatics, internal or external air hoses, wires, airbags, valves or precautionary devices for pneumatic bursting pressure shall be permitted or allowed.

### 2.7 MAGNET ASSEMBLY

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- A. A magnet shall be used as the means of keeping the nozzle and hose assembly attached to the vehicle, whether at rest or as it moves to the point of exit. The magnet disc assembly shall be slightly recessed to serve as a guide for ease of connection to the anchor plate mounted on the vehicle and serve as the contact point. The formed collar that houses the magnet shall be of a smooth and rounded configuration to prevent hooking or catching on external devices of the vehicle. The formed collar will also be the connection point between the lower and upper vertical hose. The magnet can be removed from the anchor plate by pulling up on the rear of the collar allowing the hose and nozzle assembly to come away unrestrained from the vehicle when in the parked position within the building.
- B. The Anchor Plate shall be mounted on the vehicle to allow the operator, in an upright position, to connect the magnet. The Anchor Plate shall have an outer circular isolating holder made of hard resilient plastic. Recessed in the center of the holder shall be a finished steel disc to receive the electromagnet. The Anchor Plate shall be positioned on the vehicle in relation to the vertical and horizontal centerlines of the tail pipe outlet.

### 2.8 END STOP

- A. The Rail shall be equipped with an End Stop, one for each Trolley, which is designed to stop the travel of the entire hose, nozzle, and balancer assembly. The stopping action itself must be spring cushioned to prevent the assembly from coming to an abrupt and immediate halt at an exit speed of up to 15 mph. The End Stop consists of a coiled spring hydraulic oil damper, which is located in the front end of the each Suction unit.
- B. Once the trolley has stopped the hose will extend to the pre adjusted length of the internal steel cable. One end of the internal steel cable is attached to the trolley and the other end to the magnet. The steel cable is shorter than the length of hose preventing the hose from fully extending. The hose shall not be part of the pulling forces used to remove the magnet. Once the steel cable is fully extended the magnet will release from the anchor plate. The separation of the entire hose assembly from the vehicle is a one step process whereby no stress or strain is transferred from the vehicle to the exhaust hose or overhead brackets. Numerous mechanical functions to achieve nozzle separation such as valve activation, pneumatic deflation, and pulling forces to remove the nozzle from the tail pipe are not permitted. The disconnection stop shall be adjustable to create a nozzle release point at a specified distance as the vehicle exits the building. The stopping action itself must be spring cushioned to prevent the assembly from coming to an abrupt and immediate halt at an exit speed of up to 10 mph.

### 2.9 FAN AUTO-START

- A. The Fan Auto-Start serves to act as a remote control for fan start up to ensure the exhaust system is always running whenever an emergency vehicle is in operation. Upon dispatch, the exhaust fan shall automatically start and be running at full rpm prior to engine start up via a radio frequency transmitter mounted within the vehicle. The fan stays on as long as any vehicle is in operation. Upon vehicle exit or shut down, a variable timer then activates and the fan automatically turns off after a variable timed cycle. Upon vehicle return, the transmitter shall automatically activate the exhaust fan prior to the vehicle entering the building. The fan remains in operation until all vehicles are turned off and the timer then activates. The Control unit shall be FCC-approved and shall not interfere with radio communications garage doors or on board computers.

### 2.10 CENTRIFUGAL FANS

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- A. The fan shall be a direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller wheels shall be of a modified radial tip design, with top forward curve and airfoil thickness configuration characteristics. Impeller wheels shall be spark resistant and made of aluminum to prevent static electricity build up. The impeller shall be dynamically and static balanced, and of the non-overloading type to provide maximum efficiency while achieving quiet, vibrations free operation. The fan housing shall be manufactured from cast aluminum. The fan and motor assembly shall be mounted on a galvanized steel frame, which shall protect the motor, while also serving as a mounting platform for field installation. For fans 5 HP and larger, centrifugal fans shall be fully enclosed, single-width, single-inlet steel construction as required or indicated. Impeller wheels shall have backward inclined or backward curved blades of the non-overloading type. The bearings shall be self-aligned ball bearing type permanently sealed and lubricated. Fan shafts shall be steel and rotate in a non-sparking aluminum rubbing ring. Fans shall be accurately finished and shall be provided with key and key seats for impeller hubs and fan pulleys. The fans shall be furnished with factory finish protective weather coating and a drain kit. The motor shall be totally enclosed fan cooled (TEFC). Motor starters shall be magnetic with general-purpose enclosures. The fan shall be structurally supported and provided with vibration isolators as specified to ensure quiet and smooth operation. The exhaust discharge outlet shall be in compliance with ACGIH recommendations and EPA requirements. Air intakes, windows, cascade systems, prevailing currents, communications equipment and building aesthetics will be considered in the final location of the fan. Exhaust filtration systems will be provided upon request and silencers will be provided when needed. All fans are tested in accordance with AMCA Standards in an AMCA approved test facility.

### 2.11 AIR FLOW PERFORMANCE

- A. Fan capacity shall be sized as such as to deliver a minimum of 700 cfm (or as otherwise specified) at each hose drop to the vehicle being served. The exhaust system shall pull exhaust into the nozzle also inducing ambient air. The system shall be designed entirely for a negative pressure vacuum method of exhaust extraction. At no point in exhaust system will ducting be under positive pressure. The exhaust system hose nozzle shall be sized to maintain equal or larger cross sectional diameters than vehicle tailpipe. Exhaust systems, which do not size hose drops in accord with the vehicle engine capacity, as well as vehicle tailpipe diameter, shall not be accepted. The purpose of this portion of the specification is to insure that the exhaust system is designed to cool down exhaust as they are conveyed to the outside of fire station. This type of exhaust extraction keeps exhaust temperatures well below their designed temperature tolerances. This also prevents thermal break down of hose material thus adding years to system life. Exhaust systems that size exhaust drops without dilution ventilation and also down size the exhaust connection hose, unnecessarily put the vehicle engine warranty at risk. The delivered volume shall take into account all lengths of ductwork, elbows, and branches, shut off, wyes, etc., which accumulate the static pressure at the fan inlet. Manufacturer provided fans shall be performance guaranteed.

### 2.12 DUCT SYSTEM

- A. Ductwork
1. Ducts, unless otherwise specified or approved, shall be round and conform to the dimensions as shown on the drawings. Ducts shall be straight and smooth on the inside with airtight joints. Wherever ducts are used with crimped ends, the joint shall have crimp and bead arrangement. The bead shall provide a rigid stop for the mating open end to seat. Ducts shall be constructed of galvanized steel and sealed in accordance with standard SMACNA methods, for the system

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designed negative pressure in inches w.g. All duct joints to sealed and air tight.

### B. Duct Fittings

1. Reducing fittings shall have a minimum of 1" graduating increase in diameter per 8" in length. Elbows up to 12" in diameter shall have a centerline radius of not less than 1.5 times the diameter. Elbows beyond 12" in diameter shall have a centerline radius of not less than 2.5 times the diameter. Branches shall enter the mains at a specified angle of not less than 30° with the centerline of the main duct in the direction of airflow, unless otherwise indicated or approved. Flexible connections to the main or branch duct shall be braced with approved metal straps or members.

### 2.13 CONNECTIONS

- A. Where duct of dissimilar metals are connected, or where sheet metal connections are made to fan inlet and outlet, only an approved fireproof flexible connection shall be used. The connection shall be installed and securely fastened by zinc coated steel clinch type draw bands for round ducts.

### 2.14 FRAMED OPENINGS AND DUCT SLEEVES

- A. Duct sleeves shall be provided for all round ducts £15" diameter that pass-through floors, walls, ceilings, or roofs. Sleeves in non-load bearing walls shall be fabricated of 20-gauge steel conforming to ASTM A 525. Sleeves in load bearing walls shall be fabricated of standard weight galvanized steel pipe conforming to ASTM A 53. Collars for round ducts £15" shall be fabricated from 20-gauge galvanized steel. Round ducts >15" in diameter passing through floors, walls, ceilings, or roofs shall be installed through framed openings. Structural steel members for framed openings shall conform to ASTM A 36. Framed openings shall provide a 1" clearance between the duct and the opening. A closure collar of galvanized steel 3 4" wide shall be provided on each side of the walls or floors where sleeves or framed openings are provided.

### 2.15 STACKHEAD

- A. The exhaust discharge stack head will be a no loss type as recommended by ACGIH or as otherwise specified. The stack head design will protect against weather elements or introduction of debris.

### 2.16 DUCT TEST HOLES

- A. Test holes with covers shall be provided where indicated or directed, in the duct and plenum to insert Pitot tubes to take air measurements for balancing the air moving system if required.

## PART 3 EXECUTION

### 3.1 EXHAUST SYSTEM

- A. The exhaust removal system shall be installed as indicated and recommended by the manufacturer. Welding and brazing shall conform to ASME-17. Slip joints shall be sealed. Riser duct shall be supported to the structure as indicated on the drawings. Main duct shall be attached to building structural members.

### 3.2 BUILDING SURFACE PENETRATIONS

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- A. All penetrations shall be sealed. Sleeves or framed openings shall be utilized where duct penetrates building surfaces. The space between the sleeve or framed opening and the duct shall be packed with mineral wool or approved material. Closure collars shall be installed around the duct on both sides of the penetrated surface. Collars shall fit tight against the building surfaces and snug around the duct.

### 3.3 TESTS

- A. Each exhaust system and inlet shall be balanced to produce the indicated air quantities within 10 percent at the conditions shown. Any fans with bearings shall be lubricated, and the speed, direction and rotation of each fan shall be checked and verified as running correctly. The running current of each motor shall be checked and verified as correct. Upon completion and prior acceptance of the installation, the exhaust system shall be tested at the operating conditions to demonstrate satisfactory functional and operating efficiency. The Contractor shall provide all instruments, facilities, and labor required to properly conduct the tests.

### 3.4 TRAINING

- A. The Contractor, or authorized approved personnel, shall provide training to the Owner (or appointed representative) in the daily use of and maintenance of the vehicle exhaust removal system installed and specified herein.

**END OF SECTION 23 3501**

SECTION 23 3502  
VEHICLE EXHAUST EXTRACTION TRACT SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The following bid proposal includes all engineering specifications, installation, training, service and warranty for an Emergency Vehicle Exhaust Extraction System. Any deviations from this specification must be noted. Lowest priced equipment may not be approved if not considered to be equal and not in the best interest of the end user.
- B. The function of the vehicle exhaust removal system will be to source capture 100% of the exhaust emissions directly at the tail pipe of the vehicle and exhaust those emissions to a specified area safely outside the building.
- C. The exhaust system must not interfere with access to the vehicle, nor impede doorways/walkways/or exits that would endanger the welfare of fire personnel. Drooping loops of hose or the hose assembly touching the floor will not be permitted.
- D. As safety to personnel is of the utmost importance, the system shall be so designed as not to whip or fly back into quarters upon disconnection. Vehicles shall be capable of exiting quarters at normal speed without causing damage to the system or taking any portion of the hose or nozzle assembly along with the exiting vehicle.
- E. The fan shall automatically start prior to vehicle ignition.
- F. The exhaust system must move with the vehicle in a forward or reverse direction of travel and have an automatic release design without any positive locking device or air bladder that clamps or binds to the tail pipe. No system that uses the vehicles tailpipe, as a pulling force will be considered.
- G. The exhaust system shall utilize a minimum 6.25" diameter hose in order to insure that the exhaust system can accommodate vehicle apparatus checks; and not limited to just emergency departures. Any smaller hose does not offer the required cross sectional area considered adequate for the volume of hot exhaust fumes discharged during extended run times required during routine vehicle check procedures. The hose shall not contain any internal pneumatic tubing that will interfere with airflow.

1.2 SYSTEM OPERATION

- A. The auto-disconnect exhaust system shall be a magnetic release type that captures 100% of the exhaust emissions directly from the tail pipe and discharges those emissions to a specific location by means of an exhaust fan. Upon emergency dispatch of the vehicle, the exhaust fan shall automatically start prior to the engine being energized. The exhaust fan shall remain in the "on" position for as long as any engine is running. Upon vehicle exit, the hose assembly remains connected to the tail pipe and automatically disconnects at a specified distance. The nozzle and hose assembly shall smoothly separate from the vehicle and safely retract to the stored position ready to connect to the vehicle upon reentry. Upon disconnection, the hose assembly shall not be permitted to swing wide or touch the floor, possibly endangering personnel or apparatus and causing premature wear of the hose. The hose shall remain at the door, ready for reconnection. Once the apparatus has left the building, the fan will automatically shut down after a preset time interval.

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- B. Upon return, the fan is automatically activated prior to vehicle entry and the nozzle is connected to the tail pipe in a standing position. Bending over to connect the exhaust system and exposing the operator to harmful exhaust fumes is not permitted. No positive locking device or moving parts shall be permitted to be connected to the tail pipe. After the vehicle has been turned off, the fan continues to operate for a preset time interval, normally two minutes.

### 1.3 SCOPE OF WORK

- A. A licensed and insured Contractor shall furnish and install a Source Capture Emergency Vehicle Exhaust Extraction System as designed and specified for the station(s).
- B. The Contractor shall provide and install a centrifugal exhaust fan with capacity for all connected vehicles and sized for expansion if specified.
- C. The Contractor shall provide and install an automatic fan start control console. The control console and all internal components shall be UL listed and manufactured in accordance with UL standard 508A and bear the UL label.
- D. The Contractor shall provide and install all ductwork.
- E. The Contractor shall be responsible for the delivery, safe storage, and handling of the products and protect them from weather elements.

### 1.4 SUBMITTALS AND CODES

- A. The following submittals and code compliance shall be required;
  - 1. Record building dimensions, note vehicle type and prepare shop drawings that include: equipment position, dimensions, sizes, weights, performance data, and also location and size of field connections.
  - 2. Product Data: Provide manufacturer's literature and data sheets indicating rating capacities, dimensions, weights, accessories, and electrical requirements, wiring diagrams, location and size of field connections.
  - 3. Provide fan curves with specified operating point clearly plotted.
  - 4. Submit fan sound level data for fan specified.
  - 5. Manufacturer's Installation, Operation and Maintenance Manual, which outlines the procedures required for system installation, start up, operation and shut down. The instructions shall include the manufacturer's name, telephone number, model number, service manual number, parts list, and brief description of all equipment and the basic operating features. The maintenance instructions shall list routine maintenance procedures, and troubleshooting guide.
  - 6. Certifications: International Quality System Standard ISO 9001 and ISO 14001 Certified. UL Certification: UL listing, 508A Industrial Control Panel bulletin. Compliance with: NFPA 1500, Chapter 7-1.6, 2003 International Mechanical Code 502.13, NIOSH CIB #50, OSHA, 2001 American Conference of Governmental Industrial Hygienists (ACGIH) Proposed Regulations for Benzene and Diesel Exhaust Fumes. Federal Communications Commission approvals.

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7. Compliance with all State and Local mechanical, electrical and building codes: American Society of Manufacturing Engineers (ASME), National Electric Code (NEC), Uniform Building Code (UBC), American Institute of Steel Construction (AISC), Sheet Metal and Air Conditioning Contractors National Association (SMACNA), American Society of Testing Materials (ASTM).

### 1.5 QUALITY ASSURANCE

- A. All workmanship, manufacturing procedures, airflow design, and materials shall be tested and performance guaranteed.

### 1.6 EQUIPMENT WARRANTY

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of three (3) years from date of final acceptance of the complete job, against original defects of material and workmanship, or excessive wear or deterioration.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. The equipment specified herein shall be a standard product of Nederman, Incorporated or approved equal.

### 2.2 OVERHEAD TRACK

- A. The Guide Track supports and stores the horizontal hose and is mounted overhead and to the side of the vehicle. Mounted to the guide track is a 6.2" diameter flexible hose with individual inner trolleys, which ride inside the guide track and permit the flexible hose to expand and contract while the vehicle is moving. This concept shall prevent any continuous hanging or drooping loops of hose, which could obstruct or hinder movement of people or vehicles in the work place. Each Horizontal Guide Track shall be provided with an adjustable self-aligning Clamping Bracket to support and connect the Guide Track to the installation brackets. The Guide Track can be mounted from 12" - 20" from the side of the vehicle to keep the hose tight to the vehicle and allow the apparatus floor to be free of unnecessary obstructions or hazards. This flexibility permits exhaust system installation in apparatus rooms with restricted clearance.

### 2.3 EXTRACTION HOSE

- A. The Horizontal Extraction Hose is suspended from the Guide Track, which stores the hose up, and out of the way to ensure a safer approach to the apparatus during a run. The Horizontal Extraction Hose shall be 6.2" in diameter and of suitable flexibility to withstand at least 100,000 cycles without tearing, perforating or collapsing (under normal use with proper installation and care). The Upper Vertical Extraction Hose shall be 6.2" in diameter, and of suitable flexibility to have a compression ratio of 8:1. The hose shall be capable of withstanding temperatures of 340° Fahrenheit continuously, and up to 370° Fahrenheit on an intermittent usage basis. (NOTE: If a 'closed type sealed system' is being used, the temperature ratings must be 680°F and 740°F respectively.) A hose diameter that is equal to or smaller than the exhaust tail pipe diameter shall not be permitted, as it does not have the volume capacity to handle all fumes emitted.

### 2.4 BALANCER

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- A. The adjustable tension Balancer shall retract the hose and nozzle away from the vehicle as it leaves the building and safely suspend the assembly off the floor in the storage position when not in use. The Balancer shall be of a cone shape drum design with reverse spring characteristics to ensure that the cord is
- B. wound onto the drum at a constant speed with constant torque. The reverse spring characteristic shall permit full spring power to the Balancer when the cord is wound onto the drum. The Balancer freely rolls in the guide track via a trolley with four composition wheels. A corrosion resistant aluminum bracket attaches the trolley to the Balancer.

### 2.5 VERTICAL HOSE

- A. The Upper Vertical Suction Hose shall be 6.2" in diameter, and of suitable flexibility to have a compression ratio of 8:1. The hose shall be capable of withstanding temperatures of 340 degrees Fahrenheit continuously, up to 370 degrees Fahrenheit on an intermittent usage basis. (NOTE: If a 'closed type sealed system' is being used, the temperature ratings must be 680°F and 740°F respectively.) The helix shall be external and made of galvanized steel or aluminum. The helix shall have high flexibility and be able to withstand oil, chemical, ozone and weather resistance.

### 2.6 NOZZLE

- A. The nozzle is designed to capture 100% of the vehicle exhaust fumes generated at the vehicle tail pipe and is held in place by spring tension in conjunction with the electromagnet connection. The nozzle permits an ambient air mix in the air stream to immediately reduce exhaust emission temperatures up to 50% at the point of capture. The reduced air stream temperatures prolong component life by not permitting thermal breakdown of materials. The Nozzle shall be designed so as not to cause or create back pressure on any vehicle engine, nor draw raw diesel or gasoline fumes into the exhaust hose while connected to a non-operating vehicle, nor create the possibility of spinning a non-lubricated turbo which could result in bearing failure. If a 'closed type sealed system' nozzle is utilized, a pressurized container is created presenting an explosive potential when drawing raw fumes from a non-operating vehicle and all system electrical components must be of explosion proof design. No closed/sealed system will be considered. These conditions are non-existent with an ambient air mix nozzle design.
- B. The operator never has to touch the Nozzle for connection, but can position the Nozzle over the tail pipe while the operator grips the hose handle and simultaneously connects the magnet to the anchor plate. Tension will be automatically applied to the Nozzle created by an internal leaf spring assembly, which holds the Nozzle firmly in place over the tail pipe. The positioning of the magnet on the vehicle, combined with the tension created at the Nozzle, shall not allow the Nozzle to come away from the tail pipe until the magnet is released from the anchor plate. The Nozzle shall be constructed of both metal and rubber, with no internal movable parts related to the connection of the Nozzle to the tail pipe. The Nozzle Hose shall be a minimum of 6.2" in diameter. The hose material shall be lightweight coated fiberglass with a smooth bore. The galvanized steel helix shall be completely rubber covered.
- C. The inlet diameter at the Nozzle is oversized to allow maximum airflow capacity for large engines and/or pump tests. The inlet boot of the Nozzle is to be made of EPDM rubber, and bonded to a sturdy 24 gauge steel conical reducer. The design of the nozzle shall allow for maximum flexibility to accept a variety of tail pipe configurations, which typically terminate at 90° to the side of the vehicle. Tail pipe adapters are not permitted nor required. No positive locking devices or a concept of a positive locking device, pneumatics, internal or external air hoses, wires, airbags, valves or precautionary devices for pneumatic bursting pressure shall be permitted or allowed.

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### 2.7 MAGNET ASSEMBLY

- A. A magnet shall be used as the means of keeping the nozzle and hose assembly attached to the vehicle, whether at rest or as it moves to the point of exit. The magnet disc assembly shall be slightly recessed to serve as a guide for ease of connection to the anchor plate mounted on the vehicle and serve as the contact point. The formed collar that houses the magnet shall be of a smooth and rounded configuration to prevent hooking or catching on external devices of the vehicle. The formed collar will also be the connection point between the lower and upper vertical hose. The magnet can be removed from the anchor plate by pulling up on the rear of the collar allowing the hose and nozzle assembly to come away unrestrained from the vehicle when in the parked position within the building.
- B. The Anchor Plate shall be mounted on the vehicle to allow the operator, in an upright position, to connect the magnet. The Anchor Plate shall have an outer circular isolating holder made of hard resilient plastic. Recessed in the center of the holder shall be a finished steel disc to receive the electromagnet. The Anchor Plate shall be positioned on the vehicle in relation to the vertical and horizontal centerlines of the tail pipe outlet.

### 2.8 DISCONNECTION STOP

- A. Affixed to the Guide Track near the exit door, shall be an adjustable spring cushioned disconnection stop. The disconnection stop will stop the trolley before it reaches the end of the track. Once the trolley has stopped the hose will extend to the pre adjusted length of the internal steel cable. One end of the internal steel cable is attached to the trolley and the other end to the magnet. The steel cable is shorter than the length of hose preventing the hose from fully extending. The hose shall not be part of the pulling forces used to remove the magnet. Once the steel cable is fully extended the magnet will release from the anchor plate. The separation of the entire hose assembly from the vehicle is a one step process whereby no stress or strain is transferred from the vehicle to the exhaust hose or overhead brackets. Numerous mechanical functions to achieve nozzle separation such as valve activation, pneumatic deflation, and pulling forces to remove the nozzle from the tail pipe are not permitted. The disconnection stop shall be adjustable to create a nozzle release point at a specified distance as the vehicle exits the building. The stopping action itself must be spring cushioned to prevent the assembly from coming to an abrupt and immediate halt at an exit speed of up to 10 mph.

### 2.9 FAN AUTO-START

- A. The Fan Auto-Start serves to act as a remote control for fan start up to ensure the exhaust system is always running whenever an emergency vehicle is in operation. Upon dispatch, the exhaust fan shall automatically start and be running at full rpm prior to engine start up via a radio frequency transmitter mounted within the vehicle. The fan stays on as long as any vehicle is in operation. Upon vehicle exit or shut down, a variable timer then activates and the fan automatically turns off after a variable timed cycle. Upon vehicle return, the transmitter shall automatically activate the exhaust fan prior to the vehicle entering the building. The fan remains in operation until all vehicles are turned off and the timer then activates. The FCC-approved transmitter does not interfere with any radio frequency transmissions.

### 2.10 CENTRIFUGAL FANS

- A. The fan shall be a direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller wheels shall be of a modified radial tip design, with top forward curve and airfoil thickness configuration characteristics. Impeller wheels shall be spark resistant and made of aluminum

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to prevent static electricity build up. The impeller shall be dynamically and static balanced, and of the non-overloading type to provide maximum efficiency while achieving quiet, vibrations free operation. The fan

- B. housing shall be manufactured from cast aluminum. The fan and motor assembly shall be mounted on a galvanized steel frame, which shall protect the motor, while also serving as a mounting platform for field installation.
- C. For fans 5 HP and larger, centrifugal fans shall be fully enclosed, single-width, single-inlet steel construction as required or indicated. Impeller wheels shall have backward inclined or backward curved blades of the non-overloading type. The bearings shall be self-aligned ball bearing type permanently sealed and lubricated. Fan shafts shall be steel and rotate in a non-sparking aluminum rubbing ring. Fans shall be accurately finished, and shall be provided with key and key seats for impeller hubs and fan pulleys. The fans shall be furnished with factory finish protective weather coating and a drain kit. The motor shall be totally enclosed fan cooled (TEFC). Motor starters shall be magnetic with general-purpose enclosures. The fan shall be structurally supported and provided with vibration isolators as specified to ensure quiet and smooth operation. The exhaust discharge outlet shall be in compliance with ACGIH recommendations and EPA requirements. Air intakes, windows, cascade systems, prevailing currents, communications equipment and building aesthetics will be considered in the final location of the fan. Exhaust filtration systems will be provided upon request and silencers will be provided when needed. All fans are tested in accordance with AMCA Standards in an AMCA approved test facility.

### 2.11 AIR FLOW PERFORMANCE

- A. Fan capacity shall be sized as such as to deliver a minimum of 700 cfm (or as otherwise specified) at each hose drop to the vehicle being served. The exhaust system shall pull exhaust into the nozzle also inducing ambient air. The system shall be designed entirely for a negative pressure vacuum method of exhaust extraction. At no point in exhaust system will ducting be under positive pressure. The exhaust system nozzle shall be sized to maintain equal or larger cross sectional diameters than vehicle tailpipe. Exhaust systems, which do not size hose drops in accord with the vehicle engine capacity, as well as vehicle tailpipe diameter, shall not be accepted. The purpose of this portion of the specification is to insure that the exhaust system is designed to cool down exhaust as they are conveyed to the outside of fire station. This type of exhaust extraction keeps exhaust temperatures well below their designed temperature tolerances. This also prevents thermal break down of hose material thus adding years to system life. Exhaust systems that size exhaust drops without dilution ventilation and also down size the exhaust connection hose, unnecessarily put the vehicle engine warranty at risk. The delivered volume shall take into account all lengths of ductwork, elbows, and branches, shut off, wyes, etc., which accumulate the static pressure at the fan inlet. Manufacturer provided fans shall be performance guaranteed.

### 2.12 DUCT WORK

- A. Ducts, unless otherwise specified or approved, shall be round and conform to the dimensions as shown on the drawings. Ducts shall be straight and smooth on the inside with airtight joints. Wherever ducts are used with crimped ends, the joint shall have crimp and bead arrangement. The bead shall provide a rigid stop for the mating open end to seat. Ducts shall be constructed of galvanized steel and sealed in accordance with standard SMACNA methods, for the system designed negative pressure in inches w.g. All duct joints to sealed and air tight.

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### 2.13 DUCT FITTINGS

- A. Reducing fittings shall have a minimum of 1" graduating increase in diameter per 8" in length. Elbows up to 12" in diameter shall have a centerline radius of not less than 1.5 times the diameter. Elbows beyond 12" in diameter shall have a centerline radius of not less than 2.5 times the diameter. Branches shall enter the mains at a specified angle of not less than 30° with the centerline of the main duct in the direction of airflow, unless otherwise indicated or approved. Flexible connections to the main or branch duct shall be braced with approved metal straps or members.

### 2.14 CONNECTIONS

- A. Where duct of dissimilar metals are connected, or where sheet metal connections are made to fan inlet and outlet, only an approved fireproof flexible connection shall be used. The connection shall be installed and securely fastened by zinc coated steel clinch type draw bands for round ducts.

### 2.15 FRAMED OPENINGS AND DUCT SLEEVES

- A. Duct sleeves shall be provided for all round ducts £15" diameter that pass through floors, walls, ceilings, or roofs. Sleeves in non-load bearing walls shall be fabricated of 20-gauge steel conforming to ASTM A 525. Sleeves in load bearing walls shall be fabricated of standard weight galvanized steel pipe conforming to ASTM A 53. Collars for round ducts £15" shall be fabricated from 20 gauge galvanized steel. Round ducts >15" in diameter passing through floors, walls, ceilings, or roofs shall be installed through framed openings. Structural steel members for framed openings shall conform to ASTM A 36. Framed openings shall provide a 1" clearance between the duct and the opening. A closure collar of galvanized steel 3 4" wide shall be provided on each side of the walls or floors where sleeves or framed openings are provided.

### 2.16 STACKHEAD

- A. The exhaust discharge stack head will be a no loss type as recommended by ACGIH or as otherwise specified. The stack head design will protect against weather elements or introduction of debris.

### 2.17 DUCT TEST HOLES

- A. Test holes with covers shall be provided where indicated or directed, in the duct and plenum to insert Pitot tubes to take air measurements for balancing the air moving system if required.

### 2.18

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Exhaust System:
  - 1. The exhaust removal system shall be installed as indicated and recommended by the manufacturer. Welding and brazing shall conform to ASME-17. Slip joints shall be sealed. Riser duct shall be supported to the structure as indicated on the drawings. Main duct shall be attached to building structural members.

### 3.2 BUILDING SURFACE PENETRATIONS

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- A. All penetrations shall be sealed. Sleeves or framed openings shall be utilized where duct penetrates building surfaces. The space between the sleeve or framed opening and the duct shall be packed with mineral wool or approved material. Closure collars shall be installed around the duct on both sides of the penetrated surface. Collars shall fit tight against the building surfaces and snug around the duct.

### 3.3 GUIDE TRACK

- A. Installation height of Guide Track shall be between 10' to 16' range or as otherwise indicated on the drawings. The Guide Track shall be installed approximately 14" from the side of the vehicle and 12" away from the side edge of the exit door. The Guide Track for the exhaust system shall include corrosion resistant brackets for ease of mounting to structural channel, trusses, or angle iron. Brackets shall be a minimum of 0.125" thickness. Mounting bolts to be no less than 0.375" diameter (structural grade 8) for connection to steel frame. Bolts required for masonry installation shall be 0.5" x 3.5" expansion bolts, or 0.375" x 4" sleeve anchors for wall mount masonry connection.
- B. Recommendation: Unistrut 1 5/8" or Angle Iron 2"x 2"x 3/16".

### 3.4 TESTS

- A. Each exhaust system and inlet shall be balanced to produce the indicated air quantities within 10 percent at the conditions shown. Any fans with bearings shall be lubricated, and the speed, direction and rotation of each fan shall be checked and verified as running correctly. The running current of each motor shall be checked and verified as correct. Upon completion and prior acceptance of the installation, the exhaust system shall be tested at the operating conditions to demonstrate satisfactory functional and operating efficiency. The Contractor shall provide all instruments, facilities, and labor required to properly conduct the tests.

### 3.5 TRAINING

- A. The Contractor, or authorized approved personnel, shall provide training to the Owner (or appointed representative) in the daily use of and maintenance of the vehicle exhaust removal system installed and specified herein.

**END OF SECTION 23 3502**

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**SECTION 23 3700  
AIR INLETS AND OUTLETS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Commercial Exhaust Range Hood.
- B. Grilles And Registers.
- C. Square Stepdown Cone Diffusers.
- D. Linear Diffusers.
- E. Linear Diffuser Supply Plenum.
- F. Louvers.
- G. Louvered Penthouses.
- H. Roof Curbs.
- I. Goosenecks.

**1.2 QUALITY ASSURANCE**

- A. Test and rate performance of air inlets and outlets per ASHRAE 70.
- B. Test and rate performance of louvers per AMCA 500L-99.
- C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

**1.3 REFERENCES**

- A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
- B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.
- E. SMACNA - Duct Construction Standards.

**1.4 REGULATORY REQUIREMENTS**

- A. Conform to ANSI/NFPA 90A.
- B. Conform to ASHRAE 90.1.

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**1.5 EXTRA STOCK**

- A. Provide clean filters in all filter return grilles at time of installation.
- B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

**PART 2 - PRODUCTS**

**2.1 COMMERCIAL EXHAUST RANGE HOOD**

- A. Hood shall be 18 gauge Type 304 stainless steel construction with #3 polished finish. All exterior seams shall be continuously welded, ground, and polished to match hood finish.
- B. Hood shall be furnished with UL classified baffle type stainless steel grease filters.
- C. Provide UL listed vapor-proof LED lights, pre-wired to junction box mounted on top of hood. Fixture shall have plastic coated glass.
- D. Unit shall have NSF label and UL label in accordance with NFPA-96 and be tested to ASTM 1704.
- E. Hood shall be listed by UL 710 for zero clearance installation.
- F. Provide slide gate exhaust balance damper in the hood construction. If the hood manufacturer does not offer the slide gate style damper as an option, the contractor shall provide and install duct mounted balancing dampers as specified in ductwork accessories.
- G. Provide full NFPA wet chemical fire suppression system including storage tank control panel, piping, detectors, nozzles, manual pull station and electric gas shutoff valve. Size system to meet the hood dimensions. System controls shall be integrated with controls for fans and lights.
- H. Manufacturer:
  - 1. Ansul R-102 System
- I. Provide variable exhaust system controller as specified below.
- J. Manufacturers:
  - 1. Kees Incorporated
  - 2. Econovent
  - 3. Captive Aire
  - 4. Accurex (Greenheck)

**2.2 AIR TERMINALS - GRILLES AND REGISTERS**

- A. Reference to a grille means an air supply, exhaust or transfer device without a damper.
- B. Reference to a register means an air supply, exhaust or transfer device with a damper.

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- C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.
- D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- E. The capacity and size of the unit shall be as shown on the drawings.
- F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. [Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70].
- G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.
- H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.
- I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.
- J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.
- K. Where specified to have filters, provide with filter rack suitable for [1" ][2"] thick MERV-8 pleated media filters. Grille border shall be fabricated from minimum 22 gauge steel or minimum 0.040-inch thick for aluminum grilles. Provide removable grille face with metal knurled knob or quarter turn fastener to allow for filter media replacement.
- L. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.
- M. Manufacturers:
  - 1. Tuttle & Bailey
  - 2. Titus
  - 3. Price
  - 4. Nailor
  - 5. Carnes
  - 6. Metalaire
  - 7. Krueger
  - 8. Anemostat

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9. Raymon Donco

### 2.3 AIR TERMINALS - SQUARE STEPDOWN CONE DIFFUSERS

- A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.
- B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.
- C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.
- D. The capacity and size of the unit shall be as shown on the drawings.
- E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. [Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70].
- F. Diffusers shall be drop face construction.
- G. Diffuser shall be entirely constructed of stamped panel and a minimum of [three][two] stepdown diffusion cones.
- H. Stepdown cones shall be mechanically fastened to panel with metal fasteners. Diffuser stepdown cones glued, fastened with plastic clips, or otherwise attached to face panel will not be acceptable.
- I. Each stepdown cone shall be one-piece stamped construction. The cones shall be removable for cleaning.
- J. Diffusers shall be constructed of minimum 24 gauge steel.
- K. Manufacturers:
  - 1. Tuttle & Bailey
  - 2. Titus
  - 3. Price
  - 4. Nailor
  - 5. Carnes
  - 6. Metalaire
  - 7. Krueger
  - 8. Anemostat
  - 9. Raymon Donco

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### 2.4 AIR TERMINALS - LINEAR DIFFUSERS

#### A. Plenum Slot Diffusers (Lay-In):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. [Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70].
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Linear diffusers and mounting frames shall be furnished as one piece up to 5' in length.
6. Diffusers shall be furnished with factory installed adjustable ["ice tong" style pattern deflectors capable of providing 180° pattern adjustment][gasket edged blade deflector].
7. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
8. Number and width of slots shall be as shown on the drawings.
9. Provide integral insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
10. Manufacturers:
  - a. Tuttle & Bailey ITPS
  - b. Carnes DA
  - c. Price TBD
  - d. Krueger PTBS
  - e. Nailor 5800
  - f. Titus TBD
  - g. Metalaire
  - h. Anemostat API
  - i. Raymon Donco SAT

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11. Linear diffusers for fire-rated ceiling shall be UL labeled with a non-adjustable air pattern. Airflow direction shall be as shown on the drawings.

12. Manufacturers for fire-rated diffusers:

- a. Kees FRK-UL
- b. Titus TBD-FR
- c. Krueger PFTBS
- d. Price TBD2-FR
- e. Raymon Donco 2000FR
- f. Metalaire

B. Linear Slot Diffusers (Continuous):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect.[ Noise in classrooms may not exceed 35 dBA or 55 dBC per ANSI Standard S12.60-2002 and ASHRAE 70].
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors capable of providing 180° pattern adjustment.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Manufacturers:

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- a. Tuttle & Bailey 6000/7000
- b. Carnes CH
- c. Price SDS
- d. Krueger 1900
- e. Nailor 5000
- f. Titus ML
- g. Anemostat SLAD
- h. Raymon Donco HPL
- i. Metalaire

### C. Linear Slot Diffusers (High Performance):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect per ANSI/ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear slot diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Manufacturers:

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- a. Price JS
- b. Titus FL
- c. Krueger DF
- d. Anemostat FF
- e. Raymon Donco WF2000
- f. Metalaire

### D. Linear Bar Grille Diffusers:

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect per ANSI/ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear bar diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each bar grille. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
8. Diffuser length and width, bar width, and spacing between bars shall be as shown on the drawings.
9. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum section for details.
10. Manufacturers:
  - a. Tuttle & Bailey 4000
  - b. Carnes CC;CT;CW
  - c. Krueger 1500/1600
  - d. Price LB

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- e. Nailor 4900
- f. Titus CT
- g. Metalaire 2000
- h. Anemostat AL/TL
- i. Raymon Donco DGB

### 2.5 AIR TERMINALS - LINEAR DIFFUSER SUPPLY PLENUM

- A. Linear diffusers shall be provided with field fabricated or prefabricated supply plenums. Plenum shall be a minimum of 2-1/2" wider than total slot width, minimum length of slot, and minimum height of 10". Plenums with end fed duct connections shall not exceed 8' in length. The cross sectional area of the plenum shall be designed for a maximum velocity of 500 fpm and the aspect ratio shall be limited to a width-to-height ratio of less than 1.5. Plenums with side outlets shall be designed for a maximum velocity of 600 fpm and inlet ducts to plenum shall be spaced 5' on center maximum. Inlet ducts to plenums shall have a maximum velocity of 900 fpm. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
- B. Plenum shall be constructed with 24 gauge galvanized steel and shall have side inlets unless shown otherwise on the drawings. Refer to Ductwork Application Schedule in Section 233100 for insulation requirements.
- C. End caps and required accessories shall be integral with the plenum or furnished and installed by the Mechanical Contractor.
- D. A manual volume damper shall be furnished and installed by the Mechanical Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings
- E. Prefabricated plenums shall be by the same manufacturer as the linear diffuser or Kees Inc.

### 2.6 LOUVERS - FIXED - ALUMINUM

- A. Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.

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- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.
- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.
- I. Manufacturers:
  - 1. Air Flow - "EA-403"
  - 2. Arrow - "EA-415-D"
  - 3. American Warming & Ventilating - "LE-21"
  - 4. Construction Specialties - "A4097"
  - 5. Dowco - "DBE-4"
  - 6. Louvers & Dampers, Inc. - "IL-23"
  - 7. Ruskin - "ELF375DX"
  - 8. Vent Products - "2760"
  - 9. Greenheck - ESD "403"
  - 10. Pottorff - EFD
  - 11. United Enertech FL-D-4

### 2.7 LOUVERS - FIXED - GALVANIZED

- A. Louvers shall be minimum 4" deep and constructed of galvanized steel with minimum 18 gauge frames and 16 gauge blades.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with 1/2" mesh 0.041 galvanized wire bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.
- E. AMCA Certified performance for 48" x 48" samples with intake airflow of 8,000 cfm shall not exhibit more than 0.19" pressure drop. Maximum water penetration shall be 0.01 ounces per square foot at the scheduled intake velocity based on 15 minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the Water Penetration Test in AMCA 500-L-07.
- F. Contractor shall provide the General Contractor with the correct sizes and locations of all louvers required in masonry walls.

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- G. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall.
- H. Louvers shall be suitable for duct connection.
- I. Manufacturers:
  - 1. Air Flow
  - 2. Arrow
  - 3. American Warming & Ventilating
  - 4. Carnes
  - 5. Dowco
  - 6. Louver and Dampers, Inc.
  - 7. Ruskin
  - 8. Vent Products
  - 9. United Enertech SFL-D-4

### 2.8 BOXED CORNER LOUVERED PENTHOUSE - ALUMINUM

- A. Louver:
  - 1. Standard Louver Construction: Louvers shall be minimum 4" deep and constructed of extruded aluminum. Blade, jamb and sill thickness shall be minimum 0.081". Blades shall be spaced at a maximum of 5.1" apart. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
  - 2. Wind Driven Rain Construction: Louvers shall be minimum 4" deep and constructed of extruded aluminum. Frame thickness shall be minimum 0.081". Blade thickness shall be 0.63". Blades shall be a horizontal, compound sinusoidal type arrangement spaced approximately 2" apart.
    - a. AMCA Certified Wind Driven Rain performance shall be as follows:
      - 1) 29 MPH wind and 3" per hour rainfall at 1,000 FPM free area velocity: Minimum 99.7% and Class A effectiveness.
      - 2) 50 MPH wind and 8" per hour rainfall at 500 FPM free area velocity: Minimum 98.4% and Class B effectiveness.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.

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- E. Louvers shall be sealed around perimeter to avoid moisture penetration between the louver frame and wall of penthouse.
- F. Penthouse structure shall be constructed of an all-welded aluminum.
- G. Curb cap shall be of 14 gauge formed aluminum with mitered corners continuously heliarc-welded. Penthouse roof shall be of the same material and cross-broken for added strength. Underside of roof shall be coated with insulating mastic.
- H. All four corners of penthouse shall be boxed and insulated with drain.
- I. Penthouse and throat shall be reinforced with extruded aluminum angle and have a minimum snow load of 40 lbs. per square foot.
- J. Inlet area shall be minimum 150% of throat area for intake hoods. Outlet area shall be minimum 125% of throat area for exhaust hoods and relief vents.
- K. Louvered penthouses shall be furnished with 12" high curb (above top of roof) and be of the size and type as shown on the drawings.
- L. Manufacturers:
  - 1. Arrow-United SPH
  - 2. American Warming & Ventilating PE
  - 3. Dowco P
  - 4. Greenheck ESD
  - 5. Louvers & Dampers Inc. EP
  - 6. Ruskn PHB
  - 7. Loren Cook PBH
  - 8. Vent Products 7200 Series
  - 9. United Enertech PFL

### 2.9 TIERED LOUVERED PENTHOUSE - ALUMINUM

- A. Louvers shall be 4" deep and constructed of extruded aluminum with mitered corners. Blade, jamb and sill thickness shall be 0.081". Aluminum hood shall be 0.063" aluminum. Blades shall be spaced approximately 4" apart.
- B. Louvers shall be of the drainable blade design with water collected on the leading edge of the blade and diverted to the jamb.
- C. Louvers shall be furnished with aluminum bird screen mounted on the inside surface.
- D. Size, cfm, finish and pressure drop for louvers shall be as scheduled on the drawings.

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- E. Penthouse structure shall be constructed of an all-welded aluminum.
- F. Curb cap shall be of 14 gauge formed aluminum with mitered corners continuously heliarc-welded. Penthouse roof shall be of the same material and cross-broken for added strength. Underside of roof shall be coated with insulating mastic.
- G. Corners of penthouse shall be mitered with internal reinforcement.
- H. Penthouse and throat shall be reinforced with extruded aluminum angle and have a minimum snow load of 40 lbs. per square foot.
- I. Inlet area shall be minimum 150% of throat area for intake hoods. Outlet area shall be minimum 125% of throat area for exhaust hoods and relief vents.
- J. Louvered penthouses shall be furnished with 12" high curb (above top of roof) and be of the size and type as shown on the drawings.
- K. Manufacturers:
  - 1. ACME LVN
  - 2. Dowco M
  - 3. Greenheck WIH
  - 4. Loren Cook TRE
  - 5. Penn Barry PH
  - 6. Ruskin PHM
  - 7. Vent Products 7100 Series
  - 8. Soler Palau RLX
  - 9. United Enertech PEL

### 2.10 ROOF HOODS

- A. Hoods shall be constructed of roll formed, interlocking aluminum panels. Vertical end panels are fully locked into hood.
- B. Top of curb to hood inlet shall be minimum of 5" .
- C. Curb cap shall be of 14 gauge formed aluminum with mitered corners continuously heliarc-welded. Hood shall be of the same material and cross-broken for added strength. Underside of hood shall be coated with insulating mastics.
- D. Hoods shall be furnished with aluminum bird screen.
- E. Hood and throat shall be reinforced with extruded aluminum angle and have a minimum snow load rating of 30 lbs. per square foot.

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- F. Size, cfm, finish and pressure drop for hoods shall be as scheduled on the drawings.
- G. Inlet area shall be minimum 150% of throat area for intake hoods. Outlet area shall be minimum 125% of throat area for exhaust hoods and relief vents.
- H. Hoods shall be furnished with 12" high curb (above top of roof) and be of the size and type as shown on the drawings.
- I. Hood shall be furnished with motorized damper unless otherwise noted on the drawings.
- J. Manufacturers:
  - 1. Ammerman
  - 2. Carnes
  - 3. Cook
  - 4. Greenheck
  - 5. ILG
  - 6. Jenco Fan
  - 7. PennBarry
  - 8. Twin City Fan & Blower
  - 9. York
  - 10. United Enertech GEV-GIV

### 2.11 ROOF CURBS

- A. Furnish and install, where shown on the drawings, prefabricated roof curbs for all rooftop hood openings.
- B. Roof Mounting Curb: Curb shall be sized to match curb cap of the hood. Curb height as shown on drawings, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.
- C. Curbs shall be unitized construction, 18 gauge galvanized steel, with continuous arc welded corner seams, insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board and damper support angle.
- D. Curb without cant - suitable for use with membrane type roof.
- E. Curb with built-in cant with step for roof insulation.
- F. Manufacturers:
  - 1. Same manufacturer as the equipment it serves or Pate, RPS, or Thy.

### 2.12 GOOSENECKS

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- A. Fabricate in accordance with SMACNA Duct Construction Standards of minimum 18 gauge galvanized steel.
- B. Mount on minimum 12 inch high curb base.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

##### A. General Installation Requirements:

- 1. Install items in accordance with manufacturers' instructions.
- 2. Install seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines, Appendix 1, Guidelines for Seismic Restraints for Kitchen Equipment".
- 3. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
- 4. Install diffusers to ductwork with air tight connections.
- 5. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
- 6. Supply air diffusers in operating rooms (Class B and C surgery) shall be opened and cleaned before the space is used.
- 7. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.

##### B. Volume Damper:

- 1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

##### C. Maintaining Duct Cleanliness:

- 1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 0500.

**END OF SECTION 23 3700**

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**SECTION 23 4000  
AIR CLEANING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

A. Filters and Filter Media.

**1.2 QUALITY ASSURANCE**

A. Provide all filters and filter banks by one manufacturer.

**1.3 REFERENCES**

- A. ANSI/UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.
- B. ANSI/UL 867 - Standard for Electrostatic Air Cleaners.
- C. ANSI/UL 900 - Test Performance of Air Filter Units.
- D. ANSI/UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- E. ASHRAE 26 - Guideline for Field Testing of General Ventilation Devices and Systems for Removal Efficiency In-Situ by Particle Size and Resistance to Flow.
- F. ASHRAE 52 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- G. ANSI/NFPA 70 - National Electrical Code.

**1.4 EXTRA STOCK**

- A. Provide a total of three (3) sets of filters for all units.
  - 1. Provide clean filters in all units at time of installation.
  - 2. Provide clean filters in all units at project final completion after all interior finishes are complete.
  - 3. Provide one additional set of replacement filters for all units. Deliver to Owner at job site.

**PART 2 - PRODUCTS**

AIA 2006	Table 2.1-3	All areas for inpatient care, treatment, and diagnosis, and those areas providing direct service or clean supplies such as sterile and clean processing	8, 30%	14, 90%
		Protective Environment Room	8, 30%	17, 99.97%

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		Laboratories	13, 80%	
		Administrative, bulk storage, soiled holding areas, food preparation areas, and laundries	8, 30%	
LEED NC 2.2 LEED 2009	EQ Credit 3.1	Construction and pre-occupancy use of AHUs require filters at all return grilles.	8, 30%	
	EQ Credit 5	Mechanically ventilated spaces	13, 80%	
ASHRAE 62.1-2007	5.9 Particulate Matter Removal	Provide filter upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to an occupiable space.	6, 25%	
	6.2.2.1	When a building location is in an area where the national standard for PM10 is exceeded. This may change to MERV 11 in a future addendum of ASHRAE 62.1	6, 25%	

**2.1 MERV 4 (FIBERGLASS THROWAWAY) - TYPE B**

- A. 1" thick fiberglass media with rigid frame and grille, minimum 20% efficiency per ASHRAE Standard 52.1 or MERV 4 per ASHRAE 52.2.

**2.2 MERV 4 (FIBERGLASS THROWAWAY) - TYPE C**

- A. 2" thick fiberglass media with rigid frame and grille, minimum 20% efficiency per ASHRAE Standard 52.1 or MERV 4 per ASHRAE 52.2.

**2.3 MERV 8 (MEDIUM EFFICIENCY) - DISPOSABLE - TYPE D**

- A. Non-woven cotton fabric, pleated media, disposable type with welded wire grid support bonded to the filter media.
- B. Heavy duty, paper board frame with diagonal support members bonded to inlet and exit sides of each pleat. Bond frame to media periphery to eliminate air bypass.
- C. 25-30% efficiency and 90-92% arrestance per ASHRAE 52.1 or MERV 8 per ASHRAE 52.2.

**2.4 MERV 11 (65% EFFICIENT) RIGID FILTER - DISPOSABLE - TYPE E**

- A. Pleated, rigid, disposable type with high density, fine fiberglass laminated to non-woven synthetic backing. Welded wire grid media support bonded to the filter media. Galvanized steel enclosing frame bonded to media periphery to eliminate air bypass.
- B. Maximum 12" thick cartridges with at least 14.5 square feet of media per square foot of face area.

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- C. 60-65% efficiency and 97% arrestance per ASHRAE 52.1 or MERV 11 per ASHRAE 52.2. Maximum 0.45" WG initial resistance at 500 fpm face velocity.

### 2.5 MERV 13 (85% EFFICIENT) RIGID FILTER - DISPOSABLE - TYPE F

- A. Pleated, rigid, disposable type with high density, fine fiberglass laminated to non-woven synthetic backing. Welded wire grid media support bonded to the filter media. Galvanized steel enclosing frame bonded to media periphery to eliminate air bypass.
- B. Maximum 12" thick cartridges with at least 14.5 square feet of media per square foot of face area.
- C. 80-85% efficiency and 98% arrestance per ASHRAE 52.1 or MERV 13 per ASHRAE 52.2. Maximum 0.60" WG initial resistance at 500 fpm face velocity.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all products per manufacturers' instructions.
- B. Seal filter media to prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan systems without filters.
- D. Install static pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and calibrate. Every filter bank, including packaged units, shall have a filter gauge.
- E. Install four (4) high efficiency filter test holes, two upstream and two downstream, at all high efficiency filter banks in air handling units and ductwork (85% efficiency and higher). Coordinate location of test holes with Owner.

**END OF SECTION 23 4000**

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**SECTION 23 5100  
BREECHINGS, CHIMNEYS AND STACKS**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. ANSI Z181.1 (UL 959) - Medium Heat Appliance Factory Built Chimneys.
- B. ANSI Z21.66 - Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- C. ANSI Z223.1 (NFPA 54) - The National Fuel Gas Code.
- D. ANSI/ASTM C64 - Refractories for Incinerators and Boilers.
- E. ANSI/UL 103 - Standard for Factory Built Chimneys for Residential Type and Building Heating Appliances.
- F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.
- G. UL 378 - Standard for Draft Equipment
- H. UL 441 - Standard for Gas Vents.
- I. UL 641 - Standard for Type L Low-Temperature Venting Systems.

**1.2 DEFINITIONS**

- A. Breeching or Vent Connector: Conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.
- B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.
- C. Combustion Air: Air that is supplied to combustion appliances to be used in the combustion of fuels and the process of venting combustion gases.
- D. Smoke Pipe: Round, single wall vent connector.
- E. Vent: Conveys flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

**1.3 DESIGN REQUIREMENTS**

- A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

**PART 2 - PRODUCTS**

**2.1 CLASS B GAS VENTS**

- A. Galvanized steel outer pipe. Aluminum liner pipe. 0.25"insulating air space between pipes. Type B listed by UL.

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- B. Inside diameter of the liner shall be as shown on the drawings.
- C. Extend up 2'-0" above the nearest obstruction within 20'-0" and terminate with a rain and bird proof cap.
- D. Install tall cone flashing and storm collar at roof.
- E. Maintain 1" clearance to all enclosures.
- F. Manufacturers:
  - 1. AMPCO
  - 2. DuraVent
  - 3. Hart & Cooley
  - 4. Heat Fab
  - 5. Metal-Fab
  - 6. Schebler
  - 7. Selkirk/Metalbestos
  - 8. Van-Packer.

### 2.2 POSITIVE PRESSURE GAS VENTS AND INTAKES (NON-CONDENSING)

- A. The venting system shall be ANSI/UL 103 listed for use in positive pressure applications. For use with equipment burning gas, liquid or solid fuels as described in NFPA 211, Section 2-3-.1 and Appendix A.
- B. The vent system shall be double wall metal with a minimum of 1" air space between the walls. Outer wall shall be aluminum coated steel 0.034" thick.
- C. The inner pipe shall be Type 316 stainless steel 0.035" thick in all sizes.
- D. Seal each inner pipe joint during field installation with RTV silicone sealant for flue gas temperatures up to 600°F. For gas temperatures over 600°F, seal the joints with #33 joint cement, rated for 125% of design temperature.
- E. The chimney termination must comply with local building codes or Appendix D, NFPA No. 211.
- F. Protect all exposed metal parts with at least one base coat and one finish coat of heat and corrosion resistant primer and exterior paint.
- G. Usage: Non-condensing boiler positive pressure gas vent.
- H. Install ventilated thimble at roof penetration.
- I. Manufacturers:

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1. AMPCO
  2. DuraVent
  3. Hart & Cooley
  4. Heat Fab
  5. Metal-Fab
  6. Schebler
  7. Security (M&G Group)
  8. Selkirk/Metalbestos
  9. Van-Packer.
- J. Chlorinated Polyvinyl Chloride Piping (CPVC):
1. Type BH Class IIB vent.
  2. Vent flue pipe shall be UL listed for Category IIB appliances with operating temperatures of up to 195°F. The closure system to be rated as gas tight for 5" w.c. positive pressure flue gas service.
  3. Tubing: Virgin rigid chlorinated polyvinyl chloride (CPVC). Copper tube size (CTS) manufactured to standard dimensional ratio (SDR) 11, ASTM D1784: ASTM D2846, NSF Certified.
  4. Joints: Solvent cement and primers shall be certified for flue gas venting applications.
  5. Fittings: Same as tubing. Fittings and tubing shall be a system provided by the same manufacturer. Threaded adapters for threaded valves shall be metal threaded adapter with solvent socket.
  6. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
  7. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
  8. Usage: Boiler combustion air intake only. CPVC shall not be permitted for use with non-condensing boiler venting.
  9. Furnish[ roof flashing with concentric roof vent kit and cap][ roof flashing with vent cap][ wall termination kit].
- K. Polypropylene Piping:
1. Vent flue pipe shall be Intertek / ETL listed to ULC-S636 Listed as a Class IIA, IIB, and IIC vent system with operating temperatures of up to 230°F. The closure system to be rated as gas tight for 5" w.c. positive pressure flue gas service.
  2. Pipe: Polypropylene; for use with ANSI Category II and IV gas-burning appliance.

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3. Joints: Polypropylene socket fused or electrofusion.
  4. Fittings: Same as pipe.
  5. Limitations: Shall not be used in a plenum unless listed ä? 25/50 per ASTM E84/UL723.
  6. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
  7. Usage: Boiler combustion air intake only. Polypropylene shall not be permitted for use with non-condensing boiler venting.
  8. Furnish[ roof flashing with concentric roof vent kit and cap][ roof flashing with vent cap][ wall termination kit].
- L. Polyvinyl Chloride Piping (PVC):
1. Tubing: Schedule 40 rigid PVC, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
  2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
  3. Fittings: Same as tubing. PVC, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.
  4. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
  5. Intake system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
  6. Usage: Boiler combustion air intake only. PVC shall not be permitted for use with any boiler venting.
  7. Furnish[ roof flashing with cap][ wall termination kit]

### 2.3 POSITIVE PRESSURE GAS VENTS AND INTAKE (CONDENSING AND HIGH EFFICIENCY)

- A. Stainless Steel (AL29-4C):
1. The venting system shall be ANSI/UL 1738.
  2. The venting system shall be double wall metal with a minimum of 1" air space between the walls. Outer wall shall be Type 430 stainless steel.
  3. The inner pipe shall be AL29-4C.
  4. Vent flue pipe shall be UL listed for Category III and IV appliances with operating temperatures of up to 480°F. The closure system to be rated as gas tight for 5" w.c. positive pressure flue gas service.
  5. Fasteners to be same material as piping and shall maintain 1" air space between walls.

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6. The joints shall be gas tight to prevent leakage of flue or condensate.
  7. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
  8. Furnish roof flashing with vent cap.
  9. Usage: Condensing and high efficiency boiler positive pressure gas vent and combustion air intake.
  10. Manufacturers:
    - a. AMPCO
    - b. DuraVent
    - c. Hart & Cooley
    - d. Heat Fab
    - e. Metal-Fab
    - f. Schebler
    - g. Selkirk/Metalbestos
    - h. Van-Packer
- B. Chlorinated Polyvinyl Chloride Piping (CPVC):
1. Type BH Class IIB Vent.
  2. Vent flue pipe shall be UL listed for Category IIB appliances with operating temperatures of up to 195°F. The closure system to be rated as gas tight for 5" w.c. positive pressure flue gas service.
  3. Tubing: Virgin rigid chlorinated polyvinyl chloride (CPVC). Copper tube size (CTS) manufactured to standard dimensional ratio (SDR) 11, ASTM D1784: ASTM D2846, NSF Certified.
  4. Joints: Solvent cement and primers shall be certified for flue gas venting applications.
  5. Fittings: Same as tubing. Fittings and tubing shall be a system provided by the same manufacturer. Threaded adapters for threaded valves shall be metal threaded adapter with solvent socket.
  6. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
  7. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
  8. Usage: Condensing and high efficiency boiler combustion air intake and vent. Include boiler manufacturer's written approval for use as a vent material.

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9. Furnish roof flashing with concentric roof vent kit and cap roof flashing with vent cap.

### C. Polypropylene Piping:

1. Vent flue pipe shall be Intertek / ETL listed to ULC-S636 Listed as a Class IIA, IIB, and IIC vent system with operating temperatures of up to 230°F. The closure system to be rated as gas tight for 5" w.c. positive pressure flue gas service.
2. Pipe: Polypropylene; for use with ANSI Category II and IV gas-burning appliance.
3. Joints: Polypropylene socket fused or electrofusion.
4. Fittings: Same as pipe
5. Limitations: Shall not be used in a plenum unless listed ä? 25/50 per ASTM E84/UL723.
6. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
7. Usage: Condensing and high efficiency boiler combustion air intake and vent. Include boiler manufacturer's written approval for use as a vent material.
8. Furnish roof flashing with concentric roof vent kit and cap roof flashing with vent cap.

### D. Polyvinyl Chloride Piping (PVC):

1. Tubing: Schedule 40 rigid PVC, normal impact Type 1, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
3. Fittings: Same as tubing. PVC, normal impact Type 1, with solvent-weld socket type ends for Schedule 40 pipe.
4. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
5. Intake system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
6. Usage: Boiler combustion air intake only. PVC shall not be permitted for use with any boiler venting.
7. Furnish roof flashing with cap.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Prior to putting boilers into operation, Contractor shall provide full penetration welds for the entire length of each pipe section for all inner and outer shell seams to prevent leakage of flue gases. Riveted, tack, or spot-welded seams are not permitted.

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- B. Install all products in accordance with manufacturer's instructions.
- C. Install in accordance with recommendations of ASHRAE - Handbook, Chapter "Chimney, Gas Vent, and Fireplace Systems", NFPA 211, and ANSI Z223.1 (NFPA 54).
- D. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.
- E. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Guide vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for duct support configuration and size. Provide expansion compensation approved by the manufacturer.
- F. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.
- G. Install vent dampers near draft hood collars and secured to breechings.
- H. Level and plumb chimneys and stacks. Provide 3/4" condensate drain at base of all chimneys and stacks over 12" diameter. Pipe condensate to nearest floor drain.
- I. Provide slip joints permitting removal of appliances without removal or dismantling of breechings, chimneys, or stacks.

**END OF SECTION 23 5100**

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**SECTION 23 5400  
FORCED AIR FURNACES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Forced Air Furnaces.

**1.2 QUALITY ASSURANCE**

- A. Conform to requirements of UL and applicable codes.
- B. Cooling system tested and rated per AHRI Standard 210.
- C. Conform to ASHRAE 90.1.

**1.3 REFERENCES**

- A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. AHRI 210 - Standard for Unitary Air-Conditioning Equipment.

**1.4 SUBMITTALS**

- A. Submit shop drawings and product data per Section 23 0500 showing dimensions, connections, arrangement, accessories, and controls.
- B. Submit manufacturer's installation instructions.
- C. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- E. Submit certification that all forced air furnaces, accessories, and components will withstand seismic forces defined in Section 23 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

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3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Bryant
- B. Carrier
- C. Lennox

#### **2.2 FABRICATION**

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- B. Combustion Chamber: Welded stainless steel.
- C. Supply Fan: Centrifugal type, rubber mounted with direct drive, rubber isolated 1750 rpm, 4-speed motor.
- D. Air Filters: 1" thick glass fiber, disposable type arranged for easy replacement.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Mount counterflow furnaces on combustible floors, on additive base.
- B. Mount air cooled condenser package on concrete pad.

**END OF SECTION 23 5400**

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**SECTION 23 7423.13  
GAS FIRED MAKE-UP AIR UNITS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Indirect Fired Make-Up Air Unit.

**1.2 QUALITY ASSURANCE**

- A. Comply with applicable regulations and have local Gas Company approval.
- B. Factory test to check construction, controls, and operation of unit and provide certification.
- C. Test operation after installation.
- D. Provide with complete one (1) year warranty. Warranty period begins at date of initial startup.
- E. Conform to ASHRAE 90.1.

**1.3 REFERENCES**

- A. AGA - Directory of Certified Appliances and Accessories.
- B. AMCA 208 - Calculation of the Fan Energy Index (FEI).
- C. ANSI Z83.18 - Recirculating Direct Gas-Fired Industrial Air Heaters.
- D. ANSI Z83.4 - Non-Recirculating Direct Gas-Fired Industrial Air Heaters.
- E. ANSI/AGA Z223.1 - National Fuel Gas Code.
- F. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- G. FM - FM Global.
- H. NFPA 70 - National Electrical Code.
- I. NFPA 90A - Installation of Air Conditioning and Ventilating System.
- J. UL - Underwriters' Laboratory.

**1.4 SUBMITTALS**

- A. Submit shop drawings per Section 23 0500 showing dimensions, connections, arrangement, accessories, electrical service and duct connections, and controls.
- B. Submit manufacturer's installation instructions.
- C. Submit operation and maintenance data including manufacturer's descriptive literature, maintenance and repair data, and parts listing.

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- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.
- E. Include data on all fans and accessories. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point
- F. Submit certification that all gas fired make-up air units, accessories, and components will withstand seismic forces defined in Section 23 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off-site until ready for installation.

## PART 2 - PRODUCTS

### 2.1 INDIRECT FIRED MAKE-UP AIR UNIT

- A. Manufacturers:
  - 1. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 230500 for additional information.
  - 2. Trane
  - 3. Sterling/Applied Air
  - 4. Modine
  - 5. Hastings

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6. Rupp
7. Reznor

### B. Manufactured Units:

1. Self-contained indirect-fired make-up air unit with burner, inlet damper, gas controls, unit controls, and all accessories noted or required for complete installation.
2. Units shall bear a UL, ETL or AGA label indicating that the units have been tested and comply with ANSI standards.
3. Floor mounted inside building.
4. Suspended mounted inside building.
5. Roof mounted, with weatherproofed panels and doors.
6. Provide volume controls to maintain building pressure control.
7. Unit to consist of [outdoor air hood,][ outdoor air louver,] outdoor air inlet damper,[ return air damper,] indirect-fired gas burner, unit cabinet and frame, supply fan,[ discharge damper,][ discharge diffusers,][ volume control,] and all unit and burner safety and control devices.
8. Controls shall be unit mounted with remote panels as indicated.

### C. Fabrication:

1. Construct heater casing and components of 18 gauge steel panels, reinforced with angles and channels for rigidity. Provide access panels to burner and blower motor assemblies.
2. Locate port on burner section for observing main and pilot flames.
3. Insulate indoor units up to burner section with 1" thick neoprene faced glass fiber insulation.
4. Finish casing and components with [heat resistant baked enamel][galvanized].

### D. Filters:

1. Provide filter section complete with removable [1"][2"] thick glass fiber, disposable filters in metal frames.

### E. Burner and Heat Exchanger:

1. Provide electronic modulating natural gas burner capable of modulating the gas input from 100% to 40% rated input. Provide with duct thermostat with remote setpoint adjustment.
2. Gas Burner: [Atmospheric][Induced draft][Forced draft] 225,000 Btu type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shutoff, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shutoff pilot.
3. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower

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motor, and after airflow proven and slight delay, allow gas valve to open.

4. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
5. Provide motorized damper with end switch to prove position before burner will fire. Inlet dampers required on indoor units. Discharge dampers required on outdoor units.
6. Provide with 20 gauge, type 409, stainless steel, burners, flue collector, heat exchanger, and tubes and headers on all furnaces.

### F. Fan:

1. Provide statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning lubricated ball bearings and V-belt drive.
2. All fan bearings shall have easily accessible grease fittings.

### G. Electrical:

1. Provide with single-point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet. All units must be so constructed that, when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120-volt duplex convenience outlet) is disconnected by means of a single disconnect.
2. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.
3. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.
4. All units shall include a transformer for controls and convenience outlet.
5. Only one power cable connection to the unit shall be necessary.

### H. Unit Controls:

1. Pre-wire unit so connection of power supply and field wiring from unit to remote control panel makes unit operative. Wiring and control enclosures shall meet NEC and local codes. Provide control voltage transformers as required. All wiring shall be in conduit or in enclosures. Provide pre-wired, numbered terminal strips for field wiring connections.
2. Provide remote control panel with Summer-Off-Winter switch, indicating lights for blower on, burner on, flame failure, low temperature and clogged filter.
3. All unit controls shall be electronic type.

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4. Interlock unit to run when vent damper opens and booster fan runs.
  5. Provide booster fan for vent and associated wiring.
  6. Provide the following safety controls: air flow switch, electronic flame safety relay, high temperature limit switch, starter interlock, high gas pressure switch, low gas pressure switch, low discharge temperature control with bypass timer.
  7. Provide outdoor thermostat to lock-out burner when outdoor temperature is above 60°F (adj.).
  8. Interlock unit to start when exhaust fan runs. Interlock burner to operate when flow switch in exhaust duct proves flow. Interlock wiring is by the Mechanical Contractor.
  9. Unit dampers shall close whenever unit is off. Dampers shall prove open before the unit operates.
- I. Discharge Temperature Controls:
1. Fixed Discharge Temperature:
    - a. Modulate burner to maintain a fixed discharge temperature at the unit mounted sensor.
    - b. Provide remote wall mounted panel for resetting discharge air temperature. Wire to unit control panel.
    - c. Controls shall be electronic.
    - d. Refer to Section 230900 for additional requirements.
    - e. Provide relays to signal the following conditions to the DDC system:
  2. Fixed Discharge Temperature with Room Temperature Override:
    - a. Modulate burner to maintain a fixed discharge temperature at the unit mounted discharge sensor.
    - b. Provide remote wall mounted panel with a room thermostat to reset the discharge temperature to maintain space temperature. Provide clear plastic guard over wall panel. Wire remote panel to unit control panel.
    - c. Controls shall be electronic.
    - d. Refer to Section 230900 for additional requirements.
    - e. Provide relays to signal the following conditions to the DDC system:
  3. Fixed Discharge Temperature with Volume Control:
    - a. Modulate burner to maintain a fixed discharge temperature at the unit mounted discharge sensor.
    - b. Provide controls to vary airflow from 25% to 100% of full capacity from differential pressure of the building. Provide [discharge damper,][ return air damper,][ variable frequency drive,] sensors, operators, and all devices required for this control.

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- c. System shall maintain proper airflow quantity to ensure products of combustion are below OSHA exposure limits.
- d. Locate all temperature and volume controls in a [unit][remote] mounted panel. Provide all control wiring and pressure sensing lines.
- e. Refer to Section 230900 for additional requirements.
- f. Provide relays to signal the following conditions to the DDC system:

### J. Gas Manifold:

- 1. Pilot line shall include: gas shutoff valve, gas regulator, pilot gas valve.
- 2. Main gas line shall include: gas shutoff valve, gas regulator, main gas valve (2 required), modulating gas valve, leakage test valve, low pressure gas switch, high pressure gas switch, vent valve between the two main gas valves and all required test valves.
- 3. Gas train shall meet [FIA/IRI, ][FM, ]local utility, and Owner's insurance company requirements.
- 4. Provide piping from vent valve to outside the building.
- 5. Provide additional regulator if the incoming gas pressure exceeds 2 psig.
- 6. Locate all valves and components in a unit mounted enclosure.

### K. Intake Hood:

- 1. Provide rain hood for rooftop inlet installation. Hood shall draw air through the bottom of the hood. Provide bird screen on inlet.
- 2. Provide turned up intake opening and hood cover with baffling to minimize snow ingestion. The air intake shall contain horizontal openings on the bottom of the cover with no vertical openings. Provide openings on four sides of the intake. Hood shall be sized at a maximum of 250 FPM at the inlet. Inlet shall be provided with wire mesh filters. Provide elbow on the unit to extend the intake opening to a minimum of 36" above the roof.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that area is ready to receive work and opening dimensions are as indicated on the shop drawings and illustrated by the manufacturer.
- B. Verify that proper power supply is available.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory-built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting frame level.

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C. All field wiring shall be per the National Electrical Code.

**3.3 MANUFACTURER'S FIELD SERVICES**

A. Provide initial start-up and shutdown during first year of operation, including routine servicing and check-out.

**END OF SECTION 23 7423.13**

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**SECTION 23 7513  
PACKAGED WATER SOURCE DEDICATED OUTSIDE AIR HANDLING UNIT**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Dedicated Indoor Air Unit.
- B. Unit Controls.

**1.2 QUALITY ASSURANCE**

- A. All insulation inside the unit and in the airstream must comply with the requirement of NFPA90A (maximum flame spread of 25 and maximum smoke developed of 50).
- B. All units must be UL or ETL listed and must contain UL labeled components.
- C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.
- D. Conform to ASHRAE 90.1 IECC.
- E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

**1.3 REFERENCES**

- A. AHRI 210 - Unitary Air Conditioning Equipment.
- B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. NFPA 70 - National Electrical Code.
- E. NFPA 90A - Installation of Air Conditioning and Ventilating System.
- F. UL - Underwriters' Laboratory.

**1.4 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 23 0500.
- B. Indicate electrical service and duct connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

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- E. Provide 8 octave maximum sound power levels at unit discharge and return connection.
- F. Submit certification that the packaged rooftop air conditioning units, accessories, and components will withstand seismic forces defined in Section 230550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- G. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Unit(s) shall be shipped with all access panels in place and suitably affixed to prevent damage during transportation and thereafter while in storage either offsite or on the jobsite.
- B. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.
- C. Unit(s) shall be stored in a clean, dry place protected from construction traffic and the natural elements.
- D. Installing contractor shall follow industry accepted practices and instructions in the Installation, Operation and Maintenance manual for moving unit(s) where required.
- E. Unit or any portion of the unit shall not be disassembled in the field, except as designed for, in order to facilitate placement into the building or mechanical space. Any disassembly of the unit or unit sections not incorporated into the basic design would act to void the unit warranty and reduce the factory quality assurance process.

### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

### 1.7 WARRANTY

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- A. Provide five (5) year manufacturer's warranty for compressors.
- B. Provide five (5) year manufacturer's warranty for heat exchanger.
- C. Provide five (5) year manufacturer's warranty for controls and electrical components (thermostats, VFD, etc.).

**1.8 MAINTENANCE SERVICE**

- A. Contractor shall furnish complete service and maintenance of packaged rooftop units for one year from Date of Substantial Completion.
- B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.
- C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of four (quarterly) filter replacements, minimum of one fan belt replacement, and controls checkout, seasonal adjustments, and recalibrations.
- D. Submit copy of service call work order or report and include description of work performed to Owner and Architect/Engineer.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 230500 for additional information.
- B. Daikin/McQuay.

Octave Band Center Frequency (Hz) (dB re: 10 <sup>-12</sup> W)	1 63	2 125	3 250	4 500	5 1000	6 2000	7 4000	8 8000
Discharge								
Inlet								

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.
- B. Verify that proper power supply is available.

**3.2 INSTALLATION**

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- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.
- C. All field wiring shall be in accordance with the National Electrical Code.
- D. P-traps must be provided for all drain pans.
- E. Comb all coils to repair bent fins.
- F. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

**END OF SECTION 23 7513**

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**SECTION 23 8126  
SPLIT SYSTEM AIR CONDITIONING UNITS**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. ARI 240 - Air Source Unitary Heat Pump Equipment
- C. ANSI NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
- E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- F. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- H. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets.
- I. FS TT-C-490 - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.
- J. UL - Underwriters' Laboratories.

**1.2 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 23 0500.
- B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.
- C. Submit manufacturer's installation instructions.
- D. Submit certification that split system air conditioning equipment, accessories, and components will withstand seismic forces defined in Section 23 0550. Include the following:
  - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

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3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.
- C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

### 1.4 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.
- B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

### 1.5 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

### 1.6 WARRANTY

- A. Provide five (5) year manufacturer's warranty on all compressors.

## PART 2 - PRODUCTS

### 2.1 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS

- A. Manufacturers:
  1. Carrier/Toshiba
  2. LG
  3. Panasonic/Sanyo
  4. Samsung
  5. Daikin Applied
  6. Trane/Mitsubishi
  7. York/Hitachi

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8. Lennox

### B. Manufactured Units:

1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
2. Assemble unit for wall-mounted or ceiling installation with service access required.
3. Performance shall be as scheduled on the drawings.
4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.
5. Provide unit with factory-supplied cleanable air filters.
6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
7. All wiring shall be in accordance with the National Electric Code (NEC).

### C. Evaporator Cabinet and Frame:

1. Cabinet:
  - a. Refer to schedule on drawings for mounting type ([wall-mounted][ ceiling-recessed cassette][, or][ ceiling concealed]).
  - b. Exposed units shall have a finished appearance with concealed refrigerant piping, condensate drain piping, and wiring connections.
2. Air Distribution Panel (for ceiling-mounted units): Heavy molded plastic 4-way discharge plenum with return air grille and unit filter. Designed for installation into T-bar ceiling system, [24" x 24"] [24" x 48"] size.

### D. Evaporator Fans and Motors:

1. Fans:
  - a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
  - b. The fan shall be statically and dynamically balanced.
  - c. The indoor fan shall have at least three speeds.
2. Motor:
  - a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.

### E. Evaporator Coils (Direct Expansion):

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1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
2. Single refrigeration circuit with externally equalized expansion valve.
3. Coils shall be pressure tested at the factory.
4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.

### F. Electrical Panel:

1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.

### G. Control:

1. The unit shall have a [hard-wired][wireless] 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.
2. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.
3. The remote controller shall have the following features:
  - a. On/Off power switch.
  - b. Mode Selector to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
  - c. Fan Setting to provide multiple fan speeds.
  - d. Swing Louver for adjusting supply louver discharge.
  - e. On/Off Timer for automatically switching the unit off or on.
  - f. Temperature Adjustment allows for the increase or decrease of the desired temperature.
  - g. Powerful Operation to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.
4. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.
5. Temperature range on the remote controller shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
6. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.
7. Integration: Manufacturer shall provide a BACnet interface with the building automation system in accordance with ASHRAE/ANSI Standard 135. This may be accomplished through a system integration panel or "gateway". Integration panels shall be provided as part of the split system.

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### H. Outdoor Unit:

#### 1. General:

- a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.

#### 2. Cabinet:

- a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.

#### 3. Fan:

- a. The fan shall be direct drive, propeller type fan with fan guard.
- b. Fan blades shall be statically and dynamically balanced.
- c. The fan shall have permanently lubricated type bearings.
- d. Motor shall be protected by internal thermal overload protection.
- e. Airflow shall be horizontal discharge.

#### 4. Coil:

- a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
- b. The coil shall be protected with an internal guard.
- c. Refrigerant flow from the condenser shall be controlled via a metering device.

#### 5. Compressor:

- a. Hermetic or scroll refrigerant compressors with resilient suspension system, [inverter driven, ]oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
- b. The outdoor unit shall have an accumulator and four-way reversing valve.

#### 6. Refrigerant:

- a. Unit shall use R-410a.
- b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

### I. Integral Condensate Pump:

1. Packaged unit matched to evaporator unit including float switch, pump, motor assembly, check valve, and reservoir.
2. Provide alarm to indicate high level reservoir.

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- Unit shall be powered from evaporator unit with appropriate field connections available.

J. Condensate Pump:

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- Verify that proper power supply is available.

#### **3.2 INSTALLATION**

A. General Installation Requirements:

- Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
- Refer to Section 230529 for concrete base for outdoor unit.
- Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
- Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".

B. Condensate Removal:

- Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.

C. Comb all coils to repair bent fins.

D. Install new filters in the unit at Substantial Completion.

E. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

#### **3.3 REFRIGERANT PIPING**

- Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.



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- B. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.
- C. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.
- D. Insulation:
  - 1. Insulate all refrigerant pipes between the heat pump and indoor units. This includes the liquid pipe, the suction pipe, the hot gas pipe, and the high/low pressure gas pipe. All fittings, valves, and specialty refrigerant components in the piping between the indoor and heat pump units shall also be insulated. The insulation shall have a continuous vapor barrier and shall pass through hangers and supports unbroken. All exterior insulated piping shall be painted with minimum of one (1) coat of UV resistant paint. Over size hangers and supports to allow the insulation to pass through unbroken. Following are the minimum insulation thicknesses unless noted otherwise in the manufacturer's literature or required by local AHJ:
    - a. Code/Year: ASHRAE 2019IECC 2018
    - b. Refrigerant Suction (40°F & Below):
      - 1) Up to 1": 1/2"
      - 2) 1" and up: 1"
    - c. Refrigerant Suction (41°F to 60°F):
      - 1) Up to 1-1/2": 1/2"
      - 2) 1-1/2" and up: 1"
    - d. Refrigerant Low Pressure Gas (141°F to 200°F):
      - 1) Up to 1-1/2": 1-1/2"
      - 2) 1-1/2" and up: 2"
    - e. Refrigerant High Pressure Gas (201°F to 250°F):
      - 1) Up to 4": 2-1/2"
    - f. Refrigerant Liquid:
      - 1) Up to 1-1/2": 1"
      - 2) 1-1/2" and up: 1-1/2"

**END OF SECTION 23 8126**

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**SECTION 23 8145  
VARIABLE REFRIGERANT FLOW HEAT PUMPS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Variable refrigerant flow split system heat pump (heat/cool).
- B. Variable refrigerant flow split system heat pump with heat recovery (simultaneous heat/cool).
- C. Refrigerant piping/tubing and insulation.

**1.2 REFERENCES**

- A. ANSI/AHRI 210/240 - Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment.
- B. ANSI/AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- C. ANSI/ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
- D. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- E. MIL-H-22547B - Heat Pump, Heating and Cooling (Unitary).

**1.3 DELIVERY STORAGE AND HANDLING**

- A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

**1.4 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data.
- B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

**1.5 WARRANTY**

- A. Installing contractor shall perform tasks required by manufacturer to ensure maximum available warranty is achieved. This will include but is not limited to:
  - 1. System design performed by manufacturer certified designer.
  - 2. System installation performed by manufacturer certified installer.
  - 3. Complete system commissioning paperwork and submit to manufacturer.
- B. Provide one (1) year manufacturer's warranty on all parts and labor (excluding compressors).

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- C. Provide minimum five (5) year manufacturer's parts warranty (one-year basic warranty plus four-year extended warranty) on all parts (excluding compressors) and one (1) year labor warranty.
- D. Provide minimum ten (10) year manufacturer's parts warranty (one-year basic warranty plus nine-year extended warranty) on all parts (excluding compressors) and one (1) year labor warranty.
- E. Provide minimum five (5) year manufacturer's compressor parts warranty.
- F. Contractor shall provide one (1) year parts and labor warranty on the associated controls system, including all devices, wiring, and programming.

### 1.6 DEMONSTRATION

- A. Engage manufacturer or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain individual units and complete system.

## PART 2 - PRODUCTS

### 2.1 PIPING

- A. Design Pressure: 450 psig.
  - 1. Maximum Design Temperature: 250°F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- B. Install in accordance with manufacturer's instructions. Install all piping, fittings, and insulation to meet manufacturer's requirements. Install units level and plumb. Evaporator fan components shall be installed using manufacturer's standard mounting devices securely fastened to building structure. Install and connect refrigerant tubing and fittings.
- C. Installing contractor shall attend manufacturer sponsored training to obtain installation certification.
- D. Installer shall supply isolation ball valves for zoned refrigerant isolation. Installer shall supply isolation ball valves with Schrader connection for isolating refrigerant charge and evacuation at each connected indoor unit and heat pump unit. Isolation ball valves, with Schrader connection, are required for instances of indoor unit isolation for troubleshooting, repair, or replacement without affecting the remainder of the system. Isolation ball valves with Schrader connection are also required at heat pump unit connection to isolate unit for troubleshooting, repair, or replacement and as required to provide partial capacity heating/cooling in the instance of a failure of one of the multiple heat pump unit compressors.
- E. Insulate all refrigerant pipes between the heat pump and indoor units. This includes the liquid pipe, the suction pipe, the hot gas pipe, and the high/low pressure gas pipe. All fittings, valves, and specialty refrigerant components in the piping between the indoor and heat pump units shall also be insulated. The insulation shall have a continuous vapor barrier and shall pass through hangers and supports unbroken. All exterior insulated piping shall be painted with minimum of one (1) coat of UV resistant

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paint. Over size hangers and supports to allow the insulation to pass through unbroken. Following are the minimum insulation thicknesses unless noted otherwise in the manufacturer's literature or required by local AHJ:

1. ASHRAE 2016:
2. IECC 2018:
  - a. Refrigerant Suction (40°F & Below):
    - 1) Up to 1": 1/2"
    - 2) 1" and up: 1"
  - b. Refrigerant Suction (41°F to 60°F):
    - 1) Up to 1-1/2": 1/2"
    - 2) 1-1/2" and up: 1"
  - c. Refrigerant Low Pressure Gas (141°F-200°F):
    - 1) Up to 1-1/2": 1-1/2"
    - 2) 1-1/2" and up: 2"
  - d. Refrigerant High Pressure Gas (201°F-250°F):
    - 1) Up to 4": 2-1/2"
  - e. Refrigerant Liquid:
    - 1) Up to 1-1/2": 1"
    - 2) 1-1/2" and up: 1-1/2"
- F. Engage manufacturer or factory-authorized service representative to perform startup service. Manufacturer shall provide on-site startup and commissioning assistance through job completion. Complete installation and startup checks according to manufacturer's written instructions.
- G. Fully charge system with refrigerant per manufacturer's requirements.
- H. Field Quality Control:
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing.
  2. Perform the following field tests and inspections, and prepare test reports:
    - a. Positive Pressure Leak Test: After installation, test for leaks by charging the system per manufacturer's airtight positive test criteria for a minimum of 24 hours. Repair leaks and retest until no leaks exist.

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- b. Negative Pressure Leak Test: After positive pressure leak test, evacuate the system with a vacuum pump per manufacturer's vacuum drying test criteria. The system shall maintain vacuum without pump operation or gauge movement for a minimum of 1 hour. If the gauge rises, the system may contain moisture or have leaks. Repair leaks and retest until no leaks exist. Manufacturer shall be present to witness the negative pressure test.
  - c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - e. Provide field test reports to manufacturer to include with manufacturer's startup report.
- I. Coordinate installation of units with architectural and electrical work. Coordinate installation of ceiling recessed units with ceiling grid layout. Additional ceiling grid reinforcement or modification is the responsibility of the Mechanical Contractor and shall be coordinated with the General Contractor.
  - J. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".
  - K. Contractor is responsible for routing all condensate drains from all indoor equipment to a nearby floor drain or standpipe. If ceiling heights or space finish does not accommodate gravity drainage, Contractor is responsible for providing a condensate pump and all electrical work required.
  - L. Contractor is responsible for installing VRF heat pump control system. Contractor shall coordinate with the Temperature Controls Contractor to determine extent of integration with building automation system (BAS). Equipment that is required to integrate the VRF heat pump system with the BAS is the responsibility of the VRF heat pump installing contractor. Final connections between VRF heat pump system and BAS shall be by the Temperature Controls Contractor.

**END OF SECTION 23 8145**

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**SECTION 26 0500  
BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 0528. This section is also applicable to Fire Alarm and Detection Systems Section 28 3100.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

**1.2 RELATED SECTIONS**

- A. Section 01 2500 - Substitution Procedures
- B. Section 01 3300 - Submittal Requirements

**1.3 REFERENCES**

- A. NFPA 70 - National Electrical Code (NEC)

**1.4 SCOPE OF WORK**

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.
- C. Description of Systems shall be as follows:
  - 1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
  - 2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
  - 3. Grounding system.
  - 4. Fire alarm system.
  - 5. Telecommunications rough-in, as shown on drawings, for installation of telecommunications equipment by others under separate contract.
  - 6. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
- D. Work Not Included:

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1. Telecommunications cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.
2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

### 1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
  2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
  3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
  4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
  5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
  6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
  7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
  8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

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9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

### C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

### D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

### E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.



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### F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

### G. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.6 COORDINATION DRAWINGS

### A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
  - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
  - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-

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mounted devices, and any item that may impact coordination with other disciplines.

- c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
  - d. Maintenance clearances and code-required dedicated space shall be included.
  - e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
  3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

### B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.
  - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

### C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
  - a. Scale of drawings:
    - 1) General plans: 1/4 Inch = 1'-0" (minimum).

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- 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
  - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
  - 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
  - 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
  3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
  4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

### D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

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- a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
  - b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
  11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
  12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

### 1.7 QUALITY ASSURANCE

#### A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

#### B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

#### C. Compliance with Codes, Laws, Ordinances:

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1. Conform to all requirements of the City of Sparks Codes, Laws, Ordinances and other regulations having jurisdiction.
  2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
  3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
  4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
  5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
  6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
  2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
  3. Pay all charges for permits or licenses.
  4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
  5. Pay all charges arising out of required inspections by an authorized body.
  6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
  7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
  8. Pay all telephone company charges related to the service or change in service.
- E. Utility Company Requirements:
1. Secure from the private or public utility company all applicable requirements.
  2. Comply with all utility company requirements.
  3. The Owner shall make application for and pay for new electrical service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and Utility Company.

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4. The contractor is responsible for completing utility requested forms and sharing utility requested load data from the construction documents.
5. Furnish the meter socket metering compartment with CT space within the main switchboard. Verify approved manufacturers and equipment with the Utility Company.
6. The Owner shall apply and pay for any changes for removal of existing electrical service by the utility company. The Contractor shall verify approved manufacturers and equipment with the Utility Company.

### F. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

### G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

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3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

### H. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

## 1.8 SUBMITTALS

- A. Submittals shall be required for items where required elsewhere in the specifications or on the drawings.
- B. Electronic Submittal Procedures:
  1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
  2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
  3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
  4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
    - a. Submittal file name: 26 XX XX.description.YYYYMMDD
    - b. Transmittal file name: 26 XX XX.description.YYYYMMDD
  5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

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### 1.9 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
  - 1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
  - 2. Submit in Excel format.
  - 3. Support values given with substantiating data.
- C. Preparation:
  - 1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
  - 2. Break down all costs into:
    - a. Material: Delivered cost of product with taxes paid.
    - b. Labor: Labor cost, excluding overhead and profit.

### 1.10 CHANGE ORDERS

- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

### 1.11 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

- A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.
- B. Keep all materials clean, dry and free from damaging environments.
- C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.
- D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.



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### 1.12 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

### 1.13 WARRANTY

- A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.
- B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.
- C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

### 1.14 INSURANCE

- A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

### 1.15 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.
- B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

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- D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.
- E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

### 1.16 PROJECT COMMISSIONING

- A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 26 0800 and provide all services as described in the Commissioning Plan.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

## PART 3 - EXECUTION

### 3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### 3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
  - 1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
  - 2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.
- B. Excavation:
  - 1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.

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2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
  3. Trim bottom and sides of excavations to grades required for foundations.
  4. Protect excavations against frost and freezing.
  5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
  6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
  7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
  8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
  9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
  10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
  11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
  12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.
- C. Dewatering:
1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.
- D. Underground Obstructions:
1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
  2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

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### E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope around utilities to 6" above utilities: Place and compact sand or to a height of 6" over utilities in 6" layers. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill from 6" above utilities to earthen grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
4. Backfill from 6" above utilities to below slabs or paved area: Where the fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM D698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D698 test.
5. Backfill Materials: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Backfill material shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Water shall not be permitted to rise in unbackfilled trenches.
6. Dispose of excess excavated earth as directed.
7. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
8. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

### F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

### 3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

- A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

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1. Placing fill over underground and underslab utilities.
  2. Covering exterior walls, interior partitions and chases.
  3. Installing hard or suspended ceilings and soffits.
- B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.
- C. Above-Ceiling Final Observation:
1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
    - a. All junction boxes are closed and identified in accordance with Section 26 0553 - Electrical Identification.
    - b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
    - c. Luminaire whips are supported above the ceiling.
    - d. Conduit identification is installed in accordance with Section 26 0553 - Electrical Identification.
    - e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
    - f. All wall penetrations have been sealed.
  2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
  3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

### 3.4 PROJECT CLOSEOUT

- A. The following paragraphs supplement the requirements of Division 1.
- B. IDPH Pre-Occupancy Requirements:
1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.
- C. Final Jobsite Observation:
1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.

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2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
  3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
  4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.
- D. The following must be submitted before Architect/Engineer recommends final payment:
1. Operation and maintenance manuals with copies of approved shop drawings.
  2. Record documents including marked-up drawings and specifications.
  3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
  4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and submit receipt to Architect/Engineer.
  5. Inspection and testing report by the fire alarm system manufacturer.
  6. Start-up reports on all equipment requiring a factory installation or start-up.
- E. Circuit Directories:
1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

### 3.5 OPERATION AND MAINTENANCE MANUALS

- A. General:
1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
  2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.
- B. Electronic Submittal Procedures:

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1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
  2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
  3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
  4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
    - a. O&M file name: O&M.div26.contractor.YYYYMMDD
    - b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
  5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
  6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
  7. All text shall be searchable.
  8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.
- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
  2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
  3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
  4. Copies of all factory inspections and/or equipment startup reports.
  5. Copies of warranties.
  6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

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7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

### 3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- D. The instructions shall include:
  1. Maintenance of equipment.
  2. Start-up procedures for all major equipment.
  3. Description of emergency system operation.
- E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.
- F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.
- G. Operating Instructions:
  1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.



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2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### 3.7 RECORD DOCUMENTS

- A. The following paragraphs supplement Division 1 requirements.
- B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.
- C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.
- D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.
- E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.
- F. Record actual routing of conduits exceeding 2 inches.

### 3.8 ADJUST AND CLEAN

- A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.
- C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### 3.9 SPECIAL REQUIREMENTS

- A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.
- B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.
- C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.
- D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.
  1. Elevator machine rooms and hoistways.

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2. Exit enclosures.
3. Other areas restricted by code.
4. Technology, data, server rooms.
5. Fire pump and sprinkler rooms.
6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

### **3.10 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION**

#### A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

#### B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

#### C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.
  - a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed

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specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.

- b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
  - c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
  - d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
    - a. Minimizing the amount of dust generated.
    - b. Reducing solvent fumes and VOC emissions.
    - c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
  4. Request that the Owner designate an IAQ representative.
  5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
  6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
  7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
  8. Request copies of and follow all Owner's IAQ and infection control policies.
  9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
  10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
  11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

### 3.11 SYSTEM STARTING AND ADJUSTING

- A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and

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verification of software, and final adjustments that may be needed.

- B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.
- C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.
- D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### 3.12 FIELD QUALITY CONTROL

#### A. General:

- 1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
- 2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
- 3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
- 4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
- 5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
- 6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

#### B. Ground Resistance:

- 1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)

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2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the Architect/Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 260526, the following shall be done to obtain the value given:
  - a. Verify that all connections in the service ground system are secure.
  - b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
  - c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
  - d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
  - a. Date of test.
  - b. Number of hours since the last rain.
  - c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
  - d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
  - e. Make, model, and calibration date of test equipment.
  - f. Tabulation of measurements taken and calculations made.

### C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
  - a. Service disconnects
  - b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
  - c. Fusible switches with ground fault relay protection.
  - d. Outside branch circuits and feeders.
  - e. Code required.

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2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- D. Arc Energy Reduction Equipment Performance Testing:
1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
    - a. All arc energy reduction systems installed.
  2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.
- E. Other Equipment:
1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.
- F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.
- G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.
- H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.
- I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

### 3.13 UTILITY REBATE

- A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.
- B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

### 3.14 READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

- A. To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.
  1. Penetrations of fire-rated construction fire sealed in accordance with specifications.

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2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 0500, cable insulation test results have been submitted.
5. Per Section 26 0500, medium voltage testing report has been submitted.
6. Per Section 26 0500, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 0500.
8. Bound copies of approved shop drawings have been submitted as per Section 26 0500.
9. Report of instruction of Owner's representative has been submitted as per Section 26 0500.
10. Fire alarm inspection and testing report has been submitted as per Sections 26 0500 and 28 3100.
11. 11. Start-up reports from factory representative have been submitted as per Section 26 0500.

Accepted by:

Prime Contractor \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION 26 0500**

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**SECTION 26 0503  
THROUGH PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Through-Penetration Firestopping.

**1.2 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.
- B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

**1.3 REFERENCES**

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. 2018 International Building Code
- J. NFPA 5000 - Building Construction Safety Code

**1.4 SUBMITTALS**

- A. Submit under provisions of Section 26 0500.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.



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2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
  4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

### 1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
  2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E84.

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### 1.7 MEETINGS

- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

### 1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. Spec Seal Firestop Products
  - 4. AD Firebarrier Protection Systems

### 2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

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F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

- a. F Rating = Floor/Wall Rating
- b. L Rating = Penetrations in Smoke Barriers

\*Alternate method of firestopping is patching opening to match original rated construction.

G. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

1. F Rating = Wall Rating
2. L Rating = Penetrations in Smoke Barriers

\*Alternate method of firestopping is patching opening to match original rated construction.

H. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

1. F Rating = Wall/Floor Rating
2. L Rating = Penetrations in Smoke Barriers

\*Alternate method of firestopping is patching opening to match original rated construction.

I. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

J. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

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### 3.2 INSTALLATION

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.
- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### 3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.4 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION 26 0503**

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**SECTION 26 0513  
WIRE AND CABLE**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Building wire
- B. Cabling for remote control, signal, and power limited circuits
- C. Fire rated and circuit integrity (CI) cable and assemblies
- D. Metal-clad cable (MC)

**1.2 RELATED WORK**

- A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

**1.3 REFERENCES**

- A. ASTM B800-05 - Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes- Annealed and Intermediate Tempered.
- B. ASTM B801-07 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
- C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- D. NFPA 70 - National Electrical Code (NEC)
- E. UL 44 - Thermoset-Insulated Wires and Cables
- F. UL 83 - Thermoplastic-Insulated Wires and Cables
- G. UL 854 - Service-Entrance Cables
- H. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords
- I. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

**1.4 SUBMITTALS**

- A. Submit shop drawings and product data under the provisions of Section 26 0500.
- B. Submit manufacturer's installation instructions.

**PART 2 - PRODUCTS**

**2.1 BUILDING WIRE**

**Wire and Cable - 26 0513**

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- A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
- B. Feeders and Branch Circuits 8 AWG and larger: Aluminum, AA-8000 series alloy, compact stranded conductor, 600-volt insulation, USE-2/RHH/RHW-2 or XHHW-2.
  - 1. Aluminum conductors shall not be allowed for the following:
    - a. Utility service entrance conductors.
    - b. Elevator equipment.
    - c. Motor loads 100A.
    - d. Emergency generator conductors to and from generator distribution panel / paralleling gear.
    - e. Refer to Section 260526 Grounding & Bonding for acceptance of AL conductors.
    - f. Refer to Section 264100 Lightning Protection System for acceptance of AL conductors.
- C. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.
- D. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Aluminum, AA-8000 series alloy, compact stranded conductor, 600-volt insulation, USE-2/RHH/RHW-2.
- E. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable for feeder and branch circuits 6 AWG and smaller.
- F. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings. Three conductor stranded copper, 600-volt XHHW-2 insulation, with copper ground and overall helical copper tape shield. Shield shall be terminated at both ends of cable with an approved termination.
- G. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
- H. Aluminum conductors are not to be used for feeds to motor loads.
- I. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

### 2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

- A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
  - 1. Fire alarm
  - 2. Low voltage switching and lighting control

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3. Electronic control
  - B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.
  - C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
  - D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

### 2.3 FIRE-RATED AND CIRCUIT INTEGRITY (CI) CABLE AND ASSEMBLIES

- A. Properties and requirements of fire rated cables and assemblies:
  1. 2HR fire rated for horizontal and vertical installations.
- B. Acceptable fire-rated cables and listed assemblies:
  1. MC Cable: Copper conductor, 600V thermoset, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire rated cable shall not be used for branch circuits that required redundant equipment ground paths per code.
    - a. Manufacturers:
      - 1) VITALink MC
      - 2) Draka Lifeline MC Series

### 2.4 METAL-CLAD CABLE (MC)

- A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.
- B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.
- C. Metal-clad cables may be used for branch circuit wiring as defined in the Electrical Code, subject to acceptance by State and local codes.
- D. Metal-clad cable shall NOT be used for circuits serving the Essential Electrical System.

## PART 3 - EXECUTION

### 3.1 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Above Accessible Ceilings:

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1. Building wire shall be installed in raceway.
  2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.
- B. All Other Locations: Building wire in raceway.
- C. Above Grade: All conductors installed above grade shall be type "THHN".
- D. Underground or In Slab: All conductors shall be type "THWN".
- E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.
1. J-hooks
  2. Bridle rings with saddle supports
- F. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.
- G. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

### 3.2 CONTRACTOR CHANGES

- A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance conductors are based on copper conductor installed in underground electrical ducts,.
- B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

### 3.3 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
- B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.
- C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
- D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
- E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.



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- F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
- G. Splice only in junction or outlet boxes.
- H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- I. Make conductor lengths for parallel circuits equal.
- J. All conductors shall be continuous in conduit from last outlet to their termination.
- K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
- L. Cables or wires shall not be laid out on the ground before pulling.
- M. Cables or wires shall not be dragged over earth or paving.
- N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.
- P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

### 3.4 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.
- D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- F. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- G. Completely and thoroughly swab raceway system before installing conductors.
- H. Conductor Supports in Vertical Raceways:

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1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

### 3.5 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.
- D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.
- E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.
- F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.
- G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

### 3.6 FIRE-RATED CABLE AND ASSEMBLY INSTRUCTIONS

- A. Terminations of the fire-rated cable must be outside of the fire zone.
- B. Fire-rated cable shall be installed according to the manufacturer's instructions, recommendations, and UL listing.
- C. Route fire-rated cable and assemblies separate from other feeders and distribution. Install cable and assemblies in locations protected from physical damage.
- D. Refer to Electrical Identification Section 260553 for specific identification requirements.

### 3.7 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.

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- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
  - 1. Facing the front and operating side of the equipment, the phase identification shall be:
    - a. Left to Right - A-B-C
    - b. Top to Bottom - A-B-C
- J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.
- K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

### 3.8 MC CABLE INSTALLATION

- A. AC/MC shall NOT be used for circuits serving the Essential Electrical System.
- B. Cable shall be supported by an approved means every 4.5' and within 12" of outlet boxes, junction boxes, cabinets, or fittings.
- C. Cable may be unsupported in the following conditions:
  - 1. Cable is no longer than 2' in length at terminals where flexibility is necessary.
  - 2. Cable is not more than 4.5' from the last point of support for connections within an accessible ceiling to light fixtures or equipment.

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- D. Conductor ampacity shall be derated as required by the Electrical Code where more than three current carrying conductors are used.
- E. Each 120 and 277-volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.
- F. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.
- G. Bending radius shall comply with the requirements listed in the Electrical Code for the type and size of cable being installed, but shall not be less than 5-times the diameter of the cable in any case.
- H. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless the design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.

### 3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.
- C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.
- D. Inspect wire and cable for physical damage and proper connection.
- E. Torque test conductor connections and terminations to manufacturer's recommended values.
- F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.
- G. Provide documentation of the manufacturer's recommended lug torque value for Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.
- H. Protection of wire and cable from foreign materials:
  - 1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

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- I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

**END OF SECTION 26 0513**

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**SECTION 26 0517  
ELECTRIC HEAT TRACE AND SNOW MELT**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Heat tracing cables
- B. Snow and ice melting cables
- C. Controls

**1.2 REFERENCES**

- A. NFPA 70 - National Electrical Code (NEC)
- B. ASTM 2633 - Standard Test Method for Thermoplastic Insulations
- C. ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials
- D. UL 746B - Polymeric Materials - Long Term Property Evaluations
- E. NFPA 13 - Standard for Installation of Sprinkler Systems

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 26 0500.
- B. Product Data: For each type of product indicated.
  - 1. Field Test Reports: Submit written test reports to include test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Submit manufacturer's instructions under provisions of Section 26 0500.

**1.4 COORDINATION**

- A. Coordinate layout and installation of electrical heating cables and system components with General Contractor.
- B. Coordinate installation of snow-melting cable with installation of concrete framework and concrete placement.

**1.5 WARRANTY**

- A. Provide a two (2) year warranty under provisions of Section 26 0500.

**PART 2 - PRODUCTS**

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### 2.1 HEAT-TRACING CABLE

#### A. Self-Regulating Heating Cable:

1. Cable shall be capable of crossing over itself without overheating.
2. Provide power end seals and splices as required.
  - a. Each circuit shall be protected by a 30-mA ground-fault protection device. Provide number of breakers based on manufacturer's maximum length for startup at 0°F. Identify breaker in panel directory as "HEAT TAPE".
3. Heat tape shall be meggered prior to insulating piping.
4. HT-: Suitable for freeze protection of above grade insulated metal or plastic piping, valves, and equipment to maintain fluid temperature above 40°F. 5 watts per foot @ 50°F, 120 V.
  - a. Manufacturers:
    - 1) Ray-Chem XL1
    - 2) Chromalox SRL
    - 3) Thermon BSX
    - 4) Delta-Therm IN
5. HT-: Suitable for freeze protection of underground insulated metal or plastic piping to maintain fluid temperature above 40°F. 5 watts per foot, 120 V.
  - a. Manufacturers:
    - 1) Ray-Chem XL
    - 2) Chromalox SRL
    - 3) Thermon BSX
    - 4) Delta-Therm IN

### 2.2 SNOW AND ICE MELTING CABLES

#### A. Self-Regulating Cable:

1. Heat tape shall be meggered prior to paving installation.
2. Provide power connection, end seal, splices and expansion joint kits as required.
3. Each circuit shall be protected by a 30-mA ground-fault protection device. Provide number of breakers based on manufacturer's maximum length for startup at 0°F. Identify breaker in panel directory as "SNOW MELT".

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4. HT-; Suitable for installation in concrete pavement to melt snow and ice. 35 watts per square foot, 208 V. Cables must be secured to reinforcing steel or mesh. Cable spacing shall not exceed 12". Cables must be installed 1-1/2" to 2" below finished surface.
  - a. Manufacturers:
    - 1) Ray-Chem EM2-XR
    - 2) Chromalox
    - 3) Thermon
    - 4) Delta-Therm
5. HT-; Suitable for use on roof eaves, downspouts, and gutters for snow and ice melting. 12 watts per foot in ice or snow and 5 watts per foot in air, 208 V. Cables shall be attached with manufacturer approved clips for all roof surfaces, valleys, and downspout hangers.
  - a. Manufacturers:
    - 1) Ray-Chem GM-1XT or GM-2XT
    - 2) Chromalox
    - 3) Thermon
    - 4) Delta-Therm

### 2.3 CONTROLS

- A. SMP-; Snow Melt Control Panel with Remote Snow Sensors:
  1. NEMA 3R 120-volt, adjustable hold-on timer, automatic/off/manual switch. Provide with remote Class II aerial solid state precipitation and temperature sensor, and a pavement-mounted snow sensor. Two (10mA) override inputs and four (10mA) contacts to support remote monitoring and control.
  2. Manufacturers:
    - a. Environmental Technology
    - b. Inc. APS-3C
    - c. Ray-Chem
    - d. Chromalox APS-3C
- B. SMP-; Snow Melt Distribution and Control Panel with Remote Snow Sensors:
  1. Branch circuit and control panel. NEMA 3R/4 enclosure. 208 volt 3 phase 200-amp main breaker circuit breaker panel with 2 pole 30mA ground fault protection branch breakers. Snow melt control panel with adjustable hold-on timer, automatic/off/manual switch. Provide with remote Class II aerial solid state precipitation and temperature sensor and a pavement-mounted snow



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sensor. Two (10mA) override inputs and four (10mA) contacts to support remote monitoring and control.

2. Manufacturers:

- a. Pentair SMPG1

C. SMS-; Pavement mounted Deicing/Snow Controller:

1. Control sensor that senses precipitation and temperature to energize contactor circuit under conditions indicating snow. 24 volt. Provided remote 30-amp contactor with 24-volt control transformer for snow melt control.

2. Manufacturer:

- a. Environmental Technology, Inc. HSC-4 & SC-40C contactor

D. Ambient Thermostat:

1. Remote bulb unit with adjustable temperature range from 15°F to 150°F snap action, open-on-rise, single-pole double throw switch with 22A 125/250/480VAC ratings. Provide one pipe thermostat for each circuit of heat trace.

2. Manufacturer:

- a. Pentair AMC-1A

E. Pipe Thermostat:

1. Ambient sensing unit with adjustable temperature range from 15°F to 150°F snap action; open-on-rise, single-pole double throw switch with 22A 125/250/480VAC ratings; and remote bulb for directly sensing pipe-wall temperature. Provide one pipe thermostat for each circuit of heat trace.

2. Manufacturer:

- a. Pentair AMC-1A

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surface and substrates to receive heating cables for compliance with requirements for installation, tolerances, and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electrical heating cables are free of burrs and sharp protrusions.
2. Ensure pipe testing is complete.
3. Ensure surfaces and substrates are level and plumb.

- B. Test cables for electrical continuity before installing.

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- C. Test cables for insulation resistance before installing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Verify field measurements are as shown on the Drawings.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. The heating cable shall be protected from where it leaves the pavement to the junction box by installing the cable in rigid metal conduit. Use one conduit for each heating cable.
- C. Avoid crossing expansion, construction, or control joints with heating cables. Provide sufficient slack conductor in expansion loop.
- D. Do not energize cables embedded in concrete, asphalt, or plaster until those assemblies are cured, except for brief testing.
- E. Install cables after applying bituminous binder course to lower base. Ensure that second labeling bituminous binder is applied to cables before pouring finish topping.
- F. Provide labeling in paving where snow melt cables are present. A metal plate or stamp used prior to concrete setting must contain the name of the snow melt company, the word "CAUTION", the phrase "EMBEDDED SNOW MELTING SYSTEM", and the date the system was installed. The labeling of the system must be able to handle the outdoor environment without degrading.
- G. Provide labeling to outside of the pipe thermal insulation weather barrier to indicate the presence of electric heating tracing. Labeling should contain the name of the heat trace company, the word "CAUTION" and the phrase "ELECTRIC HEAT TRACE". Labels should be placed every ten feet of pipe alternating on either side of the pipe.

### 3.3 CONNECTIONS

- A. Cable splices and repairs shall be made using a splice kit provided by the manufacturer and specifically designed for that purpose.
- B. Power connection and end seal junction box shall be mounted above grade. The junction box shall be installed in such a way so that water cannot enter it.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect cable for physical damage before installation.
- B. Test cables for electrical continuity before energizing.
- C. Test cables for insulation resistance before energizing. Remove cables if measured resistance is less than 10 megohms to ground.
- D. Repeat test for continuity and insulation resistance after applying.

**END OF SECTION 26 0517**

**Electric Heat Trace and Snow Melt - 26 0517**

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**SECTION 26 0526  
GROUNDING AND BONDING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Equipment grounding system
- B. Bonding system
- C. Grounding electrode system

**1.2 REFERENCES**

- A. NFPA 70 - National Electrical Code (NEC)
- B. NFPA 99 - Standard for Healthcare Facilities

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 26 0500.
- B. Product Data: For each type of product indicated.
- C. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

**1.4 SUMMARY**

- A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**PART 2 - PRODUCTS**

**2.1 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Division 26 Section 26 0513 - Wire and Cable.
- B. Material: Aluminum.
- C. Equipment Grounding Conductors: Insulated. Refer to Section 26 0553 for insulation color.

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- D. Isolated Ground Conductors: Insulated. Refer to Section 26 0553 for insulation color.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Copper Bonding Conductors: As follows:
  - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
  - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
  - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Aluminum Bonding Conductors: As follows:
  - 1. Bonding Cable: 10 strands of No. 14 AWG aluminum conductor, 1/4 inch in diameter.
  - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded aluminum conductor.
  - 3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; 1-5/8 inches wide and 1/16 inch thick.
- I. GB; Grounding Bar:
  - 1. Bare, annealed copper bars of rectangular cross section, with insulators. 1/4" x 2", length of technology or applicable room.
- J. IBT; Intersystem Bonding Termination:
  - 1. Copper bar, 1/4" x 2" x 24". Provide with wall mounting brackets, insulators and pre-tapped holes.
  - 2. Manufacturers:
    - a. Harger GBI Series.
    - b. Erico EGB Series.

### 2.2 CONNECTOR PRODUCTS

- A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- C. Bolted Connectors: Bolted-pressure-type connectors.
- D. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

### Grounding and Bonding - 26 0526

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### 2.3 GROUNDING ELECTRODES

- A. Ground Rods Copper-clad steel.
- B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.
- C. Test Wells: Provide handholes as shown on drawings.
- D. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to Electrical Code, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG or 20 feet of 1/2" steel reinforcing bar.

## PART 3 - EXECUTION

### 3.1 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

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- F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.
- G. Underground Connections: Exothermic-welded connections. Use for underground connections, except those at test wells.
- H. Connections at Test Wells: Use compression-type connectors on conductors and make two bolted- and clamped-type connections between conductors and ground rods.
- I. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.
- J. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.2 INSTALLATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.
- C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.
- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. In raceways, use insulated equipment grounding conductors.
- F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- G. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

### 3.3 EQUIPMENT GROUNDING SYSTEM

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- A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.
- B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:
  - 1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
  - 2. Single-phase and three-phase motor and appliance branch circuits.
  - 3. Flexible raceway runs, including FMC and LFMC.
  - 4. Armored and metal-clad cable runs.
- D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- E. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- F. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- G. Isolated Grounding Circuits: Install an insulated equipment grounding conductor connected to the receptacle or equipment grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at isolated equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

### 3.4 BONDING SYSTEM

- A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.
- B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.
- C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.
- D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

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- E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.
- F. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.
- G. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.
- H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.
- I. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.
- J. Terminal Cabinets: Terminate bonding conductor on cabinet grounding terminal.
- K. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.
- L. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- M. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- N. Medical Gas Piping: Bond to pipe with grounding clamp connectors. Bonding conductor shall be a #6 AWG minimum and may be connected to panelboard ground bar serving the area.

### 3.5 GROUNDING ELECTRODE SYSTEM

- A. Ground Ring (Counterpoise):
  - 1. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at average distances not more than 60 feet apart. Provide a grounding conductor, electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2 AWG for ground ring and for tap to building steel. Bury conductor not less than 30 inches below grade, 24 inches from building foundation, and 18 inches outside of roof drip line.
- B. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.
- C. Provide bonding at Utility Company's metering equipment and pad mounted transformer.



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- D. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.
- G. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.
- H. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.
- I. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- J. Concrete-Encased Grounding Electrode (Ufer): Install concrete-encased grounding electrode encased in at least 2 inches of concrete horizontally within the foundation that is in contact with the earth. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

### 3.6 CONCRETE OR WOOD BUILDING GROUNDING SYSTEM

- A. Provide a copper common grounding electrode conductor for the attachment of multiple separately derived systems in accordance with Electrical Code. Individual grounding conductor taps from the separately derived systems to the common grounding electrode shall be sized in accordance with Electrical Code. All tap connections shall be made in an accessible location in such a manner that common grounding electrode conductor remains without a splice or joint.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

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1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
4. Testing: Perform the following field quality-control testing:
  - a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
  - c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
    - 1) Equipment Rated 500 kVA and Less: 10 ohms.
    - 2) Equipment Rated 500 to 1000 kVA: 5 ohms.
    - 3) Equipment Rated More Than 1000 kVA: 3 ohms.
    - 4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
    - 5) Manhole Grounds: 10 ohms.
  - d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect/Engineer promptly and include recommendations to reduce ground resistance.

### 3.8 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

**END OF SECTION 26 0526**

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**SECTION 26 0527  
SUPPORTING DEVICES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Conduit and Equipment Supports
- B. Fastening Hardware
- C. Concrete Housekeeping Pads
- D. Foundation and Underground Sleeves and Seals

**1.2 QUALITY ASSURANCE**

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

**1.3 COORDINATION**

- A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Allied Support Systems
- B. Cooper B-Line
- C. Hilti
- D. Power Fasteners

**2.2 MATERIAL**

- A. Support Channel: stainless steel for wet/damp locations; painted steel.
- B. Hardware: Corrosion resistant.
- C. Anchorage and Structural Attachment Components:
  - 1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
    - a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
  - 2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A325.

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3. Welding Lugs: Comply with MSS-SP-69, Type 57.
4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangers. Single-sided type is not acceptable.
5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

### D. Conduit Sleeves and Lintels:

1. Refer to Structural General Notes for lintel requirements in masonry construction.
2. Refer to Structural plans and specifications for lintel requirements and sizes.
3. Lintels:
  - a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
  - b. All lintels shall have a minimum of 8" end bearing.
  - c. All lintels in exterior wall construction shall be hot-dip galvanized.
  - d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:
    - 1) 0 to 2'-0" span: 5/16" plate (3/4" less than wall width)
    - 2) 2'-0" to 4'-0" span: L 3 1/2 x 3 1/2 x 1/4
    - 3) 4'-0" to 6'-0" span: L4 x 3 1/2 x 5/16 (1lv)
    - 4) 6'-0" to 8'-0" span: L5 x 3 1/2 x 5/16 (1lv)
  - e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.

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4. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
5. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
6. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
7. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
8. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
9. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
10. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
11. Size sleeves large enough to allow expansion and contraction movement.

### E. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

### F. Rooftop Support System:

1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.

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3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
4. Products:
  - a. Anvil International HBS-Base Series
  - b. Cooper B-Line Dura-Blok
  - c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).
- G. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:
  1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
  2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
    - a. The hanger is attached within 6" from a web/chord joint.
    - b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.
  3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
  4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

**2.3 FOUNDATION - UNDERGROUND SLEEVES AND SEALS**

- A. Wall Seals ("Link-Seals"):
  1. Where shown on the drawings, raceways passing through foundation walls to an underground condition shall have their annular space (sleeve or drilled hole – not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
  2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.
  3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
  4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
  5. Sealing Elements shall be as follows:

		Element	
Model	Service	Material	Temperature Range

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S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

B. Approved Manufacturers:

1. Thunderline Corporation "Link-Seals"
2. O-Z/Gedney Company
3. Calpico, Inc
4. Innerlynx

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.
- B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.
- C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.
- E. Do not use powder-actuated anchors without specific permission.
- F. Do not drill structural steel members.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.
- I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent

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electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

- L. Refer to Section 26 0533 for special conduit supporting requirements.

### 3.2 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
- B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

**END OF SECTION 26 0527**



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**SECTION 26 0533  
CONDUIT AND BOXES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Rigid metallic conduit and fittings (RMC)
- B. Stainless steel conduit (316SS) and fittings
- C. Intermediate metallic conduit and fittings (IMC)
- D. Electrical metallic tubing and fittings (EMT)
- E. Flexible metallic conduit and fittings (FMC)
- F. Liquidtight flexible metallic conduit and fittings (LFMC)
- G. Rigid polyvinyl chloride conduit and fittings (PVC)
- H. High density polyethylene conduit and fittings (HDPE)
- I. Reinforced thermosetting resin conduit (RTRC)
- J. Phenolic reinforced thermosetting resin conduit (Phenolic RTRC)
- K. Wall and ceiling outlet boxes
- L. Electrical connection
- M. Pull and junction boxes
- N. Rough-ins
- O. Handholes
- P. Accessories

**1.2 RELATED WORK**

- A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

**1.3 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
  - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
  - 3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing

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4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
  5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
  6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. Federal Specifications (FS):
1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
  2. A-A-55810 - Specification for Flexible Metal Conduit
- C. NECA "Standards of Installation"
- D. National Electrical Manufacturers Association (NEMA):
1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
  2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
  3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
  4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation
- E. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL): Applicable Listings
1. UL 1 - Flexible Metal Conduit
  2. UL 6 - Rigid Metal Conduit
  3. UL 360 - Liquid Tight Flexible Steel Conduit
  4. UL514-B - Conduit Tubing and Cable Fittings
  5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
  6. UL651-B - Continuous Length HDPE Conduit
  7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
  8. UL797 - Electrical Metal Tubing
  9. UL1242 - Intermediate Metal Conduit
- G. American Standard of Testing and Materials (ASTM):
1. ASTM D570 - Standard Test Method for Water Absorption of Plastics
  2. ASTM D638 - Standard Test Method for Tensile Properties of Plastics

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3. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
4. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
6. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

### H. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

### 1.4 SUBMITTALS

- A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 0500 for coordination drawing requirements.

## PART 2 - PRODUCTS

### 2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

#### A. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Calbond Calpipe

#### B. Manufacturers of RMC Conduit Fittings:

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1. Appleton Electric
  2. O-Z/Gedney Co.
  3. Electroline
  4. Raco
- C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- D. Fittings and Conduit Bodies:
1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
  2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
  3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
  4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
  5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
- E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.
1. Acceptable Manufacturers:
    - a. Calbond Calpipe
    - b. Robroy
    - c. T&B Ocal
    - d. or approved equal.

### 2.2 STAINLESS STEEL CONDUIT (316SS) AND FITTINGS

- A. Manufacturers:
1. Gibson Stainless & Specialty

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2. Calbond Calpipe
  3. Calbrite
  4. Eaton/Crouse-Hinds
- B. All material shall be Type 316 stainless steel, meet ASTM A-321 and SA-312 standards, and be UL 6A approved.
- C. All conduit shall be heavy wall Schedule 40 with standard NPT threads.
- D. Minimum Size Stainless Steel: 3/4 inch, unless otherwise noted.
- E. Fittings, conduit bodies, couplings, nipples, bushings, connectors, supports, clamps, and all accessory hardware shall be made of Type 316 stainless steel.

### 2.3 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.
- B. Manufacturers:
1. Allied
  2. LTV
  3. Steelduct
  4. Wheatland Tube Co
- C. Fittings and Conduit Bodies:
1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
  2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
  3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
  4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
  5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

### 2.4 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

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### B. Manufacturers of EMT Conduit:

1. Allied
2. Calbond Calpipe
3. LTV
4. Steelduct

### C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:
  - a. Appleton Electric
  - b. O-Z/Gedney Co.
  - c. Electroline
  - d. Thomas & Betts

## 2.5 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

- A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.
- B. Manufacturers:
  1. American Flex
  2. Alflex
  3. Electri-Flex Co
  4. or approved equal.
- C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.
- D. Fittings and Conduit Bodies:

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1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:
  - a. O-Z/Gedney Co.
  - b. Thomas & Betts
  - c. Appleton Electric
  - d. Electroline

### 2.6 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

#### A. Manufacturers:

1. Anaconda Type UA
2. Electri-Flex Type LA
3. Alflex
4. Carlon (Lamson & Sessions)

#### B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

#### C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:
  - a. Appleton Electric
  - b. O-Z/Gedney Co.
  - c. Electroline
  - d. Thomas & Betts

### 2.7 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

#### A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

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- B. Acceptable Manufacturers:
  - 1. Carlon (Lamson & Sessions) Type 40
  - 2. Cantex, J.M. Mfg.
  - 3. or approved equal.
- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

**2.8 HIGH DENSITY POLYETHYLENE (HDPE)**

- A. Minimum Size: 2 inch, unless noted otherwise.
- B. Acceptable Manufacturers:
  - 1. Carlon
  - 2. Chevron Phillips Chemical Company
  - 3. or approved equal.
- C. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

ASTM Test	Description	Values HDPE
D1505	Density g/CM 3	less than 0.941
D1238	Melt Index, g/10 min Condition E	greater than 0.55 grams/10 min.
D638	Tensile Strength at yield (psi)	3000 min.
D1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D790	Flexural Modulus, MPa (psi)	less than 80,000
D746	Brittleness Temperature	-75°C Max

- D. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- E. Fitting and Conduit Bodies:
  - 1. Directional Bore and Plow Type Installation: Electrofusion or Universal Aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
  - 2. For all other type of installation: Coupler must provide a water tight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.

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3. E-loc type couplings are not acceptable in any situations.
4. Acceptable Manufacturers:
  - a. ARCON
  - b. Carlon
  - c. or approved equal.

**2.9 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC) AND FITTINGS**

- A. Minimum Size: 1 inch.
- B. Acceptable Manufacturers:
  1. Champion Fiberglass
  2. Atkore - FRE Composites
  3. or approved equal.
- C. Conduit shall be fiberglass reinforced epoxy using a filament winding process. Conduit, elbows and fittings shall be manufactured from the same resin/hardener/glass system and the same filament wound system. Resin systems shall be epoxy with no fillers. Glass used shall be E-type.
- D. Fitting and Conduit Bodies:
  1. Expansion fittings for RTRC shall be provided in accordance with Electrical Code.
  2. Joints in wet locations and underground locations shall be watertight.

**2.10 PHENOLIC REINFORCED THERMOSETTING RESIN CONDUIT AND FITTINGS (PHENOLIC RTRC)**

- A. Minimum Size: 1 inch.
- B. Manufacturers:
  1. Champion Fiberglass Flameshield XW
  2. Atkore - FRE Composites BreathSaver
  3. or approved equal.
- C. Conduit shall be low smoke, no flame, low toxicity. Conduit shall be fiberglass reinforced phenolic using a filament winding process. Conduit, elbows, conduit bodies, and fittings shall be manufactured from the same resin/hardener/glass system and the same filament wound system. Resin systems shall be phenol with no fillers. Fiberglass used shall be E-type.
- D. Fitting and Conduit Bodies:
  1. Expansion fittings shall be provided in accordance with Electrical Code.

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2. Joints in wet locations and underground locations shall be watertight.

### 2.11 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.
- B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
- C. Cast Boxes: Nema FB1, Type FD, Aluminum, cast fer alloy, or stainless steel deep type, gasketed cover, threaded hubs.
- D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
- E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
- F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
- G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

### 2.12 ECONN; ELECTRICAL CONNECTION

- A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

### 2.13 JB; PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
- C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene

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gasket and stainless steel cover screws.

E. Flanged type boxes shall be used where installed flush in wall.

### 2.14 ROUGH-IN

A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,

B. Conduit stubbed to above the lay-in ceiling.

C. RI-TECH; Technology Rough-in:

1. Rough-in shall have one (1) 1" conduit.

D. RI-TECH-W; Technology Rough-in - Wall Phone:

1. Mount on wall +54" or as noted in plans. Rough-in shall have one (1) 1" conduit.

E. RI-TECH-C; Technology Rough-in - Ceiling Flush Mounted:

1. Mount flush in finished ceiling or as noted in plans. Rough-in shall have one (1) 1" conduit.

F. RI-TV; Television Antenna Outlet Box Rough-in:

1. Rough-in shall have one (1) 3/4" conduit.

### 2.15 HANDHOLES

A. HH-#; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 10,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color. 11"W, 18"L, 18"D or dimensions as shown on plans.

1. Manufacturers:

a. Hubbell/Quazite PG#####BB18, PG#####HA00

b. Carson Industries H Series

c. Armorcast

d. Highline Products

B. HH-#; Handhole, cast iron, hot dipped galvanized with checkered cover sidewalk weatherproof box, flat neoprene cover gasket. Stainless steel screw hardware. Mounted flush in concrete. 12"W, 18"L, 12"D or dimensions as shown on plans.

1. Manufacturers:

a. Appleton Electric WYT Series, WYT 181212

b. OZ Gedney YT Series

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- c. Crouse Hinds WJBF Series
- C. HH-#; Handhole, concrete traffic box and galvanized steel checkered cover. Stainless steel hardware. Bolted cover and box rated for H/20 vehicular traffic. Reinforced concrete slab for bottom. 11"W, 18"L, 24"D or dimensions as shown on plans.
  - 1. Manufacturer:
    - a. Oldcastle Precast B1017 Box

### 2.16 ACCESSORIES

- A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.
- B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION TRAINING

- A. PVC coated rigid metal conduit, phenolic reinforced thermosetting resin conduit (phenolic RTRC), and reinforced thermosetting resin conduit (RTRC) manufacturers shall provide Contractor installation training for field cutting, joint preparation, joint assembly, field bending, and field cut sealing.

### 3.2 CONDUIT INSTALLATION SCHEDULE AND SIZING

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.
- B. Fire Rated Assemblies:
  - 1. Listed Fire Rated Assemblies: Phenolic RTRC
- C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- D. Minimum Conduit Size (Unless Noted Otherwise):
  - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
  - 2. Below Grade 5' or less from Building Foundation: 3/4 inch.

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3. Below Grade More than 5' from Building Foundation: 3/4 inch.
  4. Telecommunication Conduit: 1 inch.
  5. Controls Conduit: 3/4 inch.
- E. Conduit Embedded in Slabs above Grade:
1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
  2. Maximum size 1 inch for conduits crossing each other.
- F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

### 3.3 CONDUIT ARRANGEMENT

- A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.
- B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.
- C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
  2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.
- D. Conduit shall not share the same cell as structural reinforcement in masonry walls.
- E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.
- F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or

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electrical equipment.

- G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

### 3.4 CONDUIT SUPPORT

- A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.
  - 1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.
- B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.
- C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.
- F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.
- G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

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- K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.
- L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- M. Finish:
  - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
  - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

### 3.5 CONDUIT INSTALLATION

- A. Conduit Connections:
  - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
  - 2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
  - 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
  - 4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.
- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
  - 1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
  - 2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
  - 3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
  - 4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
    - a. A third bend is acceptable if:

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- 1) The total run is not longer than (33) feet.
- 2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

### D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.



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8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system, equal to O-Z/Gedney type EYD.
9. Horizontal conduit routing through slabs above grade
  - a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
  - b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
  - c. No conduits are allowed to be routed horizontally through slabs above grade.
10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

### 3.6 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

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- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.
- F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

### 3.7 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

- A. Conduit shall be installed away from high temperature piping and equipment.
- B. Conduit shall be installed to prevent exposure to ultraviolet radiation.
- C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.
- D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.
- E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

### 3.8 UNDERGROUND CONDUIT INSTALLATION

- A. Conduit Connections:
  - 1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.
- B. Conduit Bends (Lateral):
  - 1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.

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2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.

### C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

### D. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum  $f_c = 2500$  and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

### E. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

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### F. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).

### 3.9 BOX INSTALLATION SCHEDULE

#### A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.
4. Recessed in stud wall of kitchens and laundries.

#### B. Cast boxes shall be used in:

1. Exterior locations.
2. Hazardous locations.
3. Exposed interior locations within 8' of the highest platform level.
4. Direct contact with earth.
5. Direct contact with concrete in slab on grade.
6. Wet locations.
7. Kitchens and laundries when exposed on wall surface.

### 3.10 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
- D. Locate and install to maintain headroom and to present a neat appearance.

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- E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

### 3.11 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls.
  - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
  - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.
- C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
- D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
- E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- F. Provide knockout closures for unused openings.
- G. Support boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- I. Install boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
- K. Position outlets to locate luminaires as shown on reflected ceiling drawings.
- L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

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- N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

### 3.12 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.
- C. Do not install boxes back-to-back in walls.
  - 1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
  - 2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.
- D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

### 3.13 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
- B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.
- C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.
- D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.
- E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)
- F. Wood, plastic, or fiber plugs shall not be used for fastenings.
- G. Explosive devices shall not be used unless specifically allowed.

**END OF SECTION 26 0533**

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**SECTION 26 0535  
SURFACE RACEWAYS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Multi-outlet assemblies
- B. Architectural surface raceways
- C. Surface metal raceways
- D. Surface non-metallic raceways
- E. Auxiliary gutters (metal wireways)
- F. Auxiliary gutters (non-metallic wireways)

**1.2 REFERENCES**

- A. FS W-C-582 - Conduit, Raceway, Metal, and Fitting; Surface

**1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Section 26 0500.
- B. Include product data for surface metal raceways, multi-outlet assemblies, surface non-metallic raceways, auxiliary gutters, and accessories.

**PART 2 - PRODUCTS**

**2.1 MULTI-OUTLET ASSEMBLY**

- A. Multi-outlet Assembly: FS W-C-582; sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as a multi-outlet assembly. Surface mount.
- B. Receptacles: Convenience receptacle mounted in cover 12 inches on center. Receptacles shall be 15-amp, 125-volt, 3-wire, grounding type, specification grade. Single circuit type.
- C. Finish: Stainless steel.
- D. Fittings: Couplings, elbows, outlet and device boxes, and connectors designed for use with multi-outlet system. Provide all miscellaneous fittings for an electrically and mechanically continuous system.
- E. Manufacturers:
  - 1. Wiremold 2000 series
  - 2. Mono-Systems 1900 series
  - 3. Hubbell HBL2000 series.

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### 2.2 ARCHITECTURAL SURFACE RACEWAY

- A. Surface Metal Raceway: Steel channel with fitted cover, 3/4"x5/8" size per circuit requirements.
- B. Finish: Color selection by Architect.
- C. Fittings: Couplings, elbows, and connectors designed for use with the raceway system.
- D. Boxes and Extension Rings: Designed for use with the raceway system.
- E. Manufacturers:
  - 1. Wiremold V500/V700 series
  - 2. Mono-Systems SMS500/SMS700 series
  - 3. Hubbell HBL500/HBL700 series.

### 2.3 SURFACE METAL RACEWAY

- A. Surface Metal Raceway: FS W-C-582; sheet metal channel with fitted cover, suitable for use as a continuous surface metal raceway.
- B. Finish: Rust inhibiting primer coat for field painting. Coordinate paint color with Architect.
- C. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
- D. Boxes and Extension Rings: Designed for use with raceway systems.
- E. Coverplates shall be stainless steel.
- F. Normal power receptacles shall be same color as raceway. Coordinate color with Architect.
- G. Receptacles and outlets shown on raceway on drawings shall be mounted with overlapping faceplates in the raceway and shall not be mounted in boxes unless specifically noted otherwise.
- H. WW-; Surface metal raceway, metallic cover, minimum 2" opening, minimum 3 square inch capacity.
  - 1. Manufacturers:
    - a. Wiremold G3000
    - b. Mono-Systems SMS3200
    - c. Hubbell HBL3000 Series.
- I. WW-; Surface metal raceway, metallic cover, minimum 4" opening, power / communication divider, minimum 7.5 square inch capacity.
  - 1. Manufacturers
    - a. Wiremold G4000/G4048
    - b. Mono-Systems SMS4200

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- c. Hubbell HBL4750 Series.
- J. WW- Surface metal raceway, metallic cover, minimum 4" opening, power / communication divider, minimum 16.6 square inch capacity.
  - 1. Manufacturers:
    - a. Wiremold G6000/G4048
    - b. Mono-Systems SMS4400
    - c. Hubbell HBL6750 Series.

### 2.4 SURFACE NON-METALLIC RACEWAY

- A. Surface Non-Metallic Raceway: Polyvinyl chloride channel with fitted cover; UL listed for power conductors.
- B. Length: As shown on the drawings.
- C. Finish: Field paint with latex paint; color selected by Architect.
- D. Fittings and Accessories: Couplings, elbows, outlet and device boxes, and connectors designed for use with the raceway system.
- E. Coverplates shall be same material and finish as raceway.
- F. Normal power receptacles shall be same color as raceway. Coordinate color with Architect.
- G. Manufacturers:
  - 1. Wiremold PN20A Series
  - 2. Hubbell PW2 Series.

### 2.5 METAL WIREWAYS AND TROUGHS (WW-)

- A. General purpose Oil-tight and dust-tight Rain-tight type wireway, with knockouts without knockouts.
- B. Size: 6" x 6" with lengths as noted on the drawings. Actual lengths required shall be determined from actual site measurements and not from scaling drawings.
- C. Cover: Hinged Screw applied Flanged and gasketed cover.
- D. Connector: Slip-in construction; Flanged; hinged cover. screw applied cover.
- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wireways as required for a continuous enclosed complete system.
- F. Finish: Rust inhibiting primer coat. Coordinate paint color with Architect.
- G. Manufacturers:

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1. Hoffman F30G
2. Square D 5100
3. Hubbell-Wiegmann.

### 2.6 NON-METALLIC WIREWAYS AND TROUGHS

- A. Fiberglass polyester, extruded and fabricated to size and shape indicated, with without knockouts. Gasketed cover with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Flanged connections with stainless-steel screws and oil-resistant gaskets.
- B. Size: 4" x 4" with lengths as noted on the drawings. Actual lengths required shall be determined from actual site measurements and not from scaling the drawings.
- C. PVC plastic, extruded and fabricated to size and shape indicated, with snap on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
- E. Finish: Standard manufacturer's gray.
- F. Manufacturers:
  1. Hoffman F25 Series or pre-approved equal.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION - SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY

- A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
- B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- C. Maintain grounding continuity between raceway components to provide a continuous grounding path.
- D. Fastener: Use clips and straps suitable for the purpose.
- E. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer's raceway accessories as needed.
- F. Provide conduits to technology raceway per drawings or provide a minimum of one (1) 1-1/4" conduit per six feet of assembly (minimum 2) to above ceiling for technology requirements if assembly has technology raceway (Contractor shall provide quantities of conduits that provide maximum capacity to assembly). Provide conduits equally spaced within entire length of assembly.
- G. Provide one (1) 3/4" empty conduit per six feet of assembly (minimum 1) to above ceiling for future power needs. Provide conduits equally spaced within entire length of assembly.

#### 3.2 INSTALLATION - ARCHITECTURAL SURFACE RACEWAY

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- A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
- B. Maintain grounding continuity between raceway components to provide a continuous grounding path.
- C. Fastener: Use clips and straps suitable for the purpose.
- D. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer's raceway accessories as needed.
- E. Routing and Planning: Coordinate routings with existing vertical/horizontal building lines and features (doorways, wall trim, at wall/ceiling interface, etc.). Match the square / parallel lines of other existing features. Do not route raceway across large open spaces of the wall unless required by the application.

### 3.3 INSTALLATION - SURFACE NON-METALLIC RACEWAY

- A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
- B. Do not locate raceway near heating elements, open flames or surfaces with a probable temperature greater than 150°F.
- C. Do not locate raceway where there is a probability of contact with oils, chemicals or moisture.
- D. Contractor shall install a bonded ground conductor the entire length of the raceway.
- E. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer's raceway accessories as needed.
- F. Provide conduits to technology raceway per drawings or provide a minimum of one (1) 1-1/4" conduit per six feet of assembly (minimum 2) to above ceiling for technology requirements if assembly has technology raceway (Contractor shall provide quantities of conduits that provide maximum capacity to assembly). Provide conduits equally spaced within entire length of assembly.
- G. Provide one (1) 3/4" empty conduit per six feet of assembly (minimum 1) to above ceiling for future power needs. Provide conduits equally spaced within entire length of assembly.

### 3.4 INSTALLATION - WIREWAY AND TROUGH

- A. Bolt auxiliary gutter to steel channels fastened to the wall or in self-supporting structure. Install level.
- B. Gasket each joint in oil-tight gutter.
- C. Mount rain-tight gutter in horizontal position only.
- D. Coordinate installation with other trades on project to avoid interferences. Relocation of equipment shall be at Contractor's expense at the direction of the Architect/Engineer to resolve interference problems.

**END OF SECTION 26 0535**

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**SECTION 26 0542  
EQUIPMENT WIRING SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical connections to equipment specified under other Sections or furnished by the Owner.

**1.2 REFERENCES**

- A. NEMA WD 1 - General Purpose Wiring Devices
- B. NEMA WD 6 - Wiring Device Configurations
- C. NFPA 70 - National Electrical Code (NEC)

**PART 2 - PRODUCTS**

**2.1 CORDS AND CAPS**

- A. Straight-blade Attachment Plug: NEMA WD 1.
- B. Locking-blade Attachment Plug: NEMA WD 5.
- C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.
- D. Cord Construction: Oil-resistant thermoset insulated Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.
- E. Cord Size: Suitable for connected load of equipment and rating of branch circuit over-current protection.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

**3.2 PREPARATION**

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

**3.3 INSTALLATION**

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
- B. Make cord connections to equipment using flexible conduit. Use liquidtight flexible conduit in damp or wet locations.
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

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- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
- G. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

**END OF SECTION 26 0542**

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**SECTION 26 0548  
SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Seismic Requirements.

**1.2 QUALITY ASSURANCE**

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 26 0527 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

- C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

- D. Installer: Company specializing in performing the work of this Section.

**1.3 REFERENCES**

- A. International Building Code, 2018, with Northern Nevada Amendments.
- B. ASHRAE - A Practical Guide to Seismic Restraint.
- C. ASCE 7-16, Chapter 13.

**1.4 SUBMITTALS**

- A. Submit under provisions of Section 26 0500.

- B. Shop Drawings:

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1. Calculations, restraint selections, and installation details shall be designed and sealed by a Professional Structural Engineer licensed in the state where the project is located experienced in seismic restraint design and installation.
  2. Coordination Drawings: Plans and sections drawn to scale, coordinating seismic bracing of electrical components with other systems and equipment in the vicinity, including other seismic restraints.
  3. Manufacturer's Certifications: Professional Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
  4. System Supports/Restraints - Submit for each condition requiring seismic bracing:
    - a. Calculations for each seismic brace and detail utilized on the project.
    - b. Plan drawings showing locations and types of seismic braces on contractor fabrication/installation drawings.
    - c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
    - d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
  5. Equipment - Submit for each piece of equipment supplied:
    - a. Certification that the equipment supplied for the project meets or exceeds the seismic requirements specified. Equipment certification is to be provided by the manufacturer
    - b. Specific details of seismic design features of equipment and maximum seismic loads imparted to the structural support.
    - c. Engineering calculations and details for equipment anchorage and support structure.
- C. A seismic restraint designer shall be provided whether or not exceptions listed in the applicable building code are met. If seismic restraints are not provided for a system that requires seismic bracing, the seismic designer shall submit a signed and sealed letter to the Architect/Engineer and Authorities Having Jurisdiction stating the exceptions, along with code reference, utilized for each item. Seismic designer shall review system installation for general conformance to the exception requirements stated in the code and document, in writing, the system has been installed in accordance to the exception.

### 1.5 TESTING AND INSPECTION

- A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the Building Code.
- B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.

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- C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.
- D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

### 1.7 DESIGN REQUIREMENTS

- A. This project is subject to the seismic bracing requirements of the International Building Code, 2018 edition.
- B. The following criteria are applicable to this project:
  - 1. Risk Category: Confirm with Architect
  - 2. Seismic Importance Factor: IE = Confirm with Architect
  - 3. Seismic Design Category: Confirm with Architect
  - 4. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.
- C. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.

### 1.8 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

## PART 2 - PRODUCTS

### 2.1 SUPPLIERS

- A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:
  - 1. B-Line Systems, Inc. (800) 851-7415, [www.b-line.com](http://www.b-line.com).

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2. Unistrut Corporation <http://www.unistrut.us/>
3. Kinetics Noise Control (877) 457-2695, [www.kineticsnoise.com](http://www.kineticsnoise.com).
4. Mason Industries, Inc. [www.mason-ind.com](http://www.mason-ind.com).
5. Loos & Co., Inc. (800) 321-5667, [www.loosnaples.com](http://www.loosnaples.com).
6. Tolco (909) 737-5599, [www.tolco.com](http://www.tolco.com)
7. ISAT 877.523.6060, [www.isatsb.com](http://www.isatsb.com)
8. Vibro-Acoustics (416) 291-7371, <https://virs.vibro-acoustics.com/>

### 2.2 SEISMIC DESIGN CRITERIA

- A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.
  1. Definitions:
    - a. Stay in Place:
      - 1) All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.
  2. Remain Operational:
    - a. Requirements for "Stay in Place" listed above shall be met.
    - b. The following systems and associated equipment are intended not to fail externally or internally and are intended to remain operational.
      - 1) Life Safety Power
      - 2) Emergency Power System
      - 3) Fire Alarm

### 2.3 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
  1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
  2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.

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3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
  4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
  5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
- B. Friction from gravity loads shall not be considered resistance to seismic forces.
- C. Housekeeping Pads:
1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

### 2.4 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

- A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.
- B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:
1. Switchboards, Distribution Panelboards, Panelboards, Load Centers
  2. Emergency Feeders
  3. Cable tray, Busway, Ductbank
  4. Transformers
  5. Disconnect Switches
  6. Magnetic, Manual, Combination Starters
  7. Variable Frequency Drives
  8. Automatic/Manual Transfer Switches
  9. Interior Luminaires
  10. Emergency Luminaires and Exit Signs
  11. Emergency Power Supply
  12. Engine Generator Systems
  13. Uninterruptible Power Supplies
  14. Fire Alarm Panel, Initiating and Notification Appliances
  15. Area of Rescue Assistance

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- 16. Nurse Call
- 17. Intercom, Sound System, Clock, TV Distribution
- 18. Security System

### 2.5 MATERIALS

- A. Use the following materials for restraints:
- B. Indoor Dry Locations: Steel, zinc plated.
- C. Outdoors and Damp Locations: Galvanized steel.
- D. Corrosive Locations: Stainless steel.

### 2.6 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.
- C. Concrete Inserts: Steel-channel type.
- D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A325.
- E. Welding Lugs: Comply with MSS SP-69, Type 57.
- F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

### 2.7 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
  - 1. Materials for Channel: ASTM A1011, GR 33.
  - 2. Materials for Fittings and Accessories: ASTM A635, ASTM A576, or ASTM A36.

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3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
  4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.
- B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.
- C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.
- D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.
- E. Installation of seismic restraints shall not cause any change in position of equipment lighting or conduits resulting in stresses or misalignment.
- F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
- G. Do not install any equipment or conduit that makes rigid connections with the building unless isolation is not specified.
- H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.
- I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
- J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.
- K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.

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- L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.
- M. Do not install cables over sharp corners.
- N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.
- O. Provide reinforced clevis bolts when required.
- P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.
- Q. Post-Installed anchors shall be provided to meet seismic requirements.
- R. Vertical conduit risers flexibly supported to accommodate thermal motion and/or conduit vibration shall be guided to maintain conduit stability and provide horizontal seismic restraint.
- S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.
- T. Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.
- U. Do not brace a system to two different structures such as a wall and a ceiling.
- V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.
- W. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.
- X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

### 3.2 SEISMIC RESTRAINT EXCLUSIONS

- A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

**END OF SECTION 26 0548**

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**SECTION 26 0553  
ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Adhesive Markings and Field Labels
- B. Nameplates and Signs
- C. Product Colors

**1.2 REFERENCES**

- A. NFPA 70E - National Electrical Safety Code
- B. NFPA 70 - National Electrical Code (NEC)
- C. ANSI A13.1 - Standard for Pipe Identification
- D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

**1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 0500.
  - 1. Product Data for each type of product specified.
  - 2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.
  - 3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.
  - 4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Divisions 22 and 23.

**PART 2 - PRODUCTS**

**2.1 ADHESIVE MARKINGS AND FIELD LABELS**

- A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
  - 1. Label Size as follows:
    - a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).
  - 2. Color: As specified for various systems.

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- B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.
- F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.
- G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.
- I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

### 2.2 NAMEPLATES AND SIGNS

- A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.
- B. Text Sizes:
  - 1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.
    - a. Text Height: 3/8 inch minimum
- C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing; and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
- E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

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- F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

### 2.3 PRODUCT COLORS

#### A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white face
2. Normal Power and General Labels: Black letters on white face
3. Control Labels: Black letters on white face
4. Medium Voltage (greater than 1,000 volts): Black letters on white face
5. Fire Alarm: Red letters on white face
6. Emergency: Red letters on white face

#### B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face
2. Control Labels: Black letters on white face
3. EMERGENCY: White letters on red face
4. GROUNDING: White letters on green face.
5. CAUTION or UPS: Black letters on yellow face

#### C. Raceways and Conduit:

1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:
  - a. Normal Power and General Distribution: Silver
  - b. Emergency Power Distribution System:
    - 1) All Emergency: Orange
    - 2) Legally Required Standby: Yellow
    - 3) Optional Standby: Orange
  - c. Fire Alarm System: Red
  - d. Temperature Controls: Refer to mechanical cover sheet for color
  - e. Ground: Green
  - f. Low Voltage and Telephone: Purple

#### D. Box Covers:

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1. Box covers shall be painted to correspond with system type as follows:
    - a. Normal Power and General: Silver
    - b. Emergency Power and Distribution:
      - 1) All Emergency: Orange
      - 2) Legally Required Standby: Yellow
      - 3) Optional Standby: Orange
    - c. Fire Alarm System: Red
    - d. Temperature Controls: Refer to mechanical cover sheet for color
    - e. Ground: Green
    - f. Low Voltage and Telephone: Purple
  2. Box cover colors shall match conduit colors listed above.
- E. Conductor Color Identification: Refer to Part 3 for additional information.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the A/E prior to installation and ordering of materials.
- C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.
- D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.
- E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.
- F. Circuit Identification: Tag or label conductors as follows:
  1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.

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2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
  3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- G. Apply warning, caution and instruction signs as follows:
1. Install warning, caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  2. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
- H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.
- I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- J. Install ARC FLASH WARNING signs on all switchboards, panelboards, industrial control panels, and motor control centers.
1. Sample Label:
    - a. ! WARNING
    - b. ARC FLASH AND SHOCK HAZARD
    - c. APPROPRIATE PPE REQUIRED
    - d. FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
    - e. REFER TO NFPA 70E
- K. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot intervals.
1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to conduits concealed within wall.

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3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
- L. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:
  1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.
- M. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

### 3.2 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

- A. Product:
  1. Adhesive labels and field markings
  2. Nameplates and signs
- B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.
- C. Identification material to be engraved plastic-laminated labels, 1/16-inch minimum thickness with white letters on a red face. Letter and number size to 1/8-inch high.
- D. Identification to be engraved directly on the stainless steel coverplates. Letter and number size to 1/8-inch high.
- E. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

### 3.3 CONDUIT AND EXPOSED CABLE LABELING

- A. Product:
  1. Adhesive labels and field markings
- B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 20 foot (6 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:

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1. Medium Voltage (greater than 1,000 volt): Indicate feeder identification and voltage.
  2. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
  3. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
  4. Fire Alarm: Indicate "FIRE ALARM".
  5. Grounding: Indicate "GROUND" and equipment and designation.
  6. Security System: Indicate "Security".
  7. Telephone System: Indicate "Telephone".
- C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

### 3.4 BOX LABELING

- A. Products:
1. Adhesive labels and field markings
- B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.
- C. All junction, pull, and connection boxes shall be identified as follows:
1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
  2. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
  3. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

### 3.5 CONDUCTOR COLOR CODING

- A. Products:
1. All wire and cables shall be color coded by the manufacturer.
  2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM.
- B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used

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throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

- C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.
- D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.
- E. Conductors shall be color coded as follows:
  - 1. 208Y/120 Volt, 4-Wire:
    - a. A-Phase - Black
    - b. B-Phase - Red
    - c. C-Phase - Blue
    - d. Neutral - White
    - e. Ground Bond - Green
  - 2. Grounding Conductors:
    - a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
    - b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.
  - 3. Cabling for Remote Control, Signal, and Power Limited Circuits:
    - a. Fire Alarm: Refer to Fire Alarm and Automatic Detection Section 283100 for cable color requirements.
    - b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
    - c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.

### 3.6 CONTROL EQUIPMENT IDENTIFICATION

- A. Products:
  - 1. Nameplates and signs
- B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.

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- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
- D. Labeling shall include:
  - 1. Equipment type and contract documents designation of equipment being served.
  - 2. Location of equipment being served if it is not located within sight.
  - 3. Voltage and phase of circuit(s).
  - 4. Panel and circuit number(s) serving the equipment.
  - 5. Method of automatic control, if included ("AUTO CONTROL BY FMCS").
  - 6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
  - 7. Date of fault current study, refer to one-line diagram
  - 8. Sample Label:
    - a. EXHAUST FAN EF-1 ("LOCATED ON ROOF")
    - b. 480V, 3-PHASE
    - c. FED FROM "IHA1-1"
    - d. AUTO CONTROL BY FMCS
    - e. 22,000 AMPS AVAILABLE FAULT CURRENT
    - f. DATE OF STUDY: 1 JAN 2017

### 3.7 EQUIPMENT CONNECTION IDENTIFICATION

- A. Products:
  - 1. Nameplates and signs
- B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.
- C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:
  - 1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handling ventilation units, condensing units, unit heaters, and similar equipment
  - 2. Plumbing equipment
  - 3. Fire protection equipment including fire pumps

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4. Medical gas equipment and equipment skids
  5. Elevator
  6. Kitchen equipment (hardwired)
  7. Industrial machinery
- D. Labeling shall include:
1. Equipment type and contract documents designation of equipment being served
  2. Location of equipment being served if it is not located within sight.
  3. Voltage and rating of the equipment.
  4. Panel and circuit numbers(s) serving the equipment
  5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
  6. Date of fault current study; refer to one-line diagram
  7. Sample Label:
    - a. UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
    - b. 480V: 3-PHASE
    - c. FED FROM "1HA1-1"
    - d. 22,000 AMPS AVAILABLE FAULT CURRENT
    - e. DATE OF STUDY: 1 JAN 2017

### 3.8 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

- A. Products:
1. Nameplates and signs
- B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
  2. Exterior Equipment: The identification material shall be engraved vinyl labels.
  3. Labeling shall include:
    - a. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

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- b. Sample Label:
  - 1) DISTRIBUTION PANEL DP-H1
  - 2) 480Y/277V
  - 3) FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)
- 4. Provide the following on a separate label, installed below the label above:
  - a. Available fault current; refer to one-line diagram or panel schedules
  - b. Date of fault current study; refer to one-line diagram
  - c. Sample Label:
    - 1) 22,000 AMPS AVAILABLE FAULT CURRENT
    - 2) DATE OF STUDY: 1 JAN 2023
- C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:
  - 1. Nominal system voltage, service wire size, quantity, material, distance
  - 2. Maximum available fault current; refer to one-line diagram for values
  - 3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 260573 for value.
  - 4. Date of fault current study; refer to one-line diagram
  - 5. Date of label
  - 6. Sample Label:
    - a. 480Y/277V, 6 SETS 4#750KCM CU, 75FT
    - b. 39,800 AMPS AVAILABLE FAULT CURRENT
    - c. 0.07 SECOND CLEARING TIME
    - d. DATE OF STUDY: 1 JAN 2017
    - e. DATE OF LABEL: 4 JUL 2017
- D. Arc Energy Reduction Label:
  - 1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.
    - a. Label: "This equipment is designed with a system listed below".
    - b. Applicable Systems:



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- 1) Zone-selective interlocking system for selective coordination and arc energy reduction
- 2) Differential relaying system for selective coordination and arc energy reduction
- 3) Arc energy reducing maintenance switch
- 4) Energy reducing active arc flash mitigation system

E. Adjustable-Trip Over Current Protection Label:

1. Provide a separate engraved plastic laminate label adjacent to each overcurrent protection device with adjustable trip settings. Provide label separate from load identification label.

a. Label:

- 1) Long-time delay:
- 2) Long-time pickup:
- 3) Short-time delay:
- 4) Short-time pickup:
- 5) Instantaneous:
- 6) Ground fault delay:
- 7) Ground fault:

b. Sample Label:

- c. Long-time delay: 10.0
- d. Long-time pickup: 1.0
- e. Short-time delay: 0.15
- f. Short-time pickup: 5.0
- g. Instantaneous: 2.0
- h. Ground fault delay: 0.25
- i. Ground fault: 50.0

F. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

- G. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a

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separate engraved plastic laminate label adjacent to each overcurrent protection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

1. Sample Labels for Feeders:

- a. 4#3/0 CU & 1#6 CU GND, 125FT
- b. 4#250KCM AL & 1#6 GND CU, 125FT
- c. 2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

H. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 260500 for other requirements.

### 3.9 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

C. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.
5. Sample Label:
  - a. TRANSFORMER TR-15
  - b. 480V: 208Y/120V 15KVA
  - c. FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

### 3.10 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

A. Products:

1. Safety Yellow paint and custom stencils

B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.

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- C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch wide stripes.
  - 1. Width of area: Width of equipment or as required by code
  - 2. Depth of area: Depth as required by code

**END OF SECTION 26 0553**

**SECTION 26 0933  
LIGHTING CONTROL SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Line and low voltage standalone lighting controls
- B. Automatic load control relay (ALCR20)
- C. Distributed lighting control
- D. Central lighting controls
- E. Time switches

**1.2 RELATED SECTIONS**

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
  - 1. 26 5119 - Lighting
  - 2. 26 5215 Emergency Lighting Inverter
  - 3. Electrical Drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

**1.3 RELATED WORK**

- A. Section 01 9113 - General Commissioning Requirements

**1.4 QUALITY ASSURANCE**

- A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. All components and assemblies are to be factory pre-tested prior to delivery and installation.
- C. Comply with Electrical Code as applicable to electrical wiring work.
- D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

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- E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
- F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

### 1.5 REFERENCES

- A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
- B. FS W S 896 Switch, Toggle
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 7 - Occupancy Motion Sensors
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL Standard 916 Energy Management Equipment
- G. UL 924 - Emergency Lighting and Power Equipment
- H. UL 1472 - Solid-State Dimming Controls

### 1.6 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.
- B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements.
- C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.
- D. Submit a list of devices and equipment that will be installed for each sequence of operation.
- E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.
- F. Coordinate integration with mechanical and/or other trades.

### 1.7 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 0500.

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- B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.
- C. Control Stations: One (1) of each configuration and type.

### 1.8 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Section 260500.
- B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

### 1.9 OPERATION AND MAINTENANCE DATA

- A. Submit emergency, operation, and maintenance data under provisions of Section 260500. Data shall also include the following:
  - 1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
  - 2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
  - 3. Replacement part numbers for all system components.
- B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

### 1.10 SYSTEM DESCRIPTION

- A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.
- B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.
  - 1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
  - 2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.
- C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

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1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.
  - a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.
3. Centralized Control: Control equipment is in a central location serving multiple spaces/zones and provides time-based schedule and remote control.

### 1.11 MOCKUP

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires and controls in mockup may be reused as part of complete work if in original condition.

### 1.12 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.
- B. This project will have selected building systems commissioned. The Contractor is responsible to execute commissioning. The commissioning process, equipment, and systems to be commissioned are defined in Division 1.
- C. The Contractor shall notify the Architect/Engineer and Owner's Representative ten (10) working days prior to scheduled commissioning date.
- D. The commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.
- E. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

### 1.13 WARRANTY

- A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.
- B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LIGHTING CONTROLS

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- A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.
- B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.
- C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

### 2.2 LIGHTING CONTROL STATION

- A. SW; The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.
  - 1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.
  - 2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

### 2.3 DEVICE COLOR

- A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

### 2.4 COVERPLATES

- A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
- B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
- C. Install nameplate identification as indicated in Section 260553.
- D. Plate-securing screws shall be metal with head color matching the wall plate finish.

### 2.5 WALL SWITCHES

- A. Refer to Electrical Symbols List for device type.
- B. SW-1P; Single Pole Switch:
  - 1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell HBL1221



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- b. Leviton 1221-2
  - c. Pass & Seymour PS20AC1
  - d. Cooper AH1221
3. Single throw, 120/277-volt, 20-amp maintained contact. Rocker handle, side and back wired.
4. Manufacturers:
- a. Hubbell DS120
  - b. Leviton 5621
  - c. Pass & Seymour 2621
  - d. Cooper 7601.
- C. SW-3W; Three-way Switch:
- 1. 120/277-volt, 20-amp maintained contact. Rocker handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell DS320
    - b. Leviton 5623
    - c. Pass & Seymour 2623
    - d. Cooper 7623
- D. SW-4W; Four-way Switch:
- 1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
  - 2. Manufacturers:
    - a. Hubbell 1224
    - b. Leviton 1224-2
    - c. Pass & Seymour PS20AC4
    - d. Cooper AH1224

### 2.6 WALL DIMMERS

- A. UL listed with integral air-gap switch for on/off control.
- B. Integral EMI/RFI suppression.
- C. Non-viewable heat sink.

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- D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.
- E. Dimmer to match device color.
- F. SW-D-LED; LED Electronic Driver Dimmer:
  - 1. 120 -volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60629 Annex E.
  - 2. Manufacturers:
    - a. Compatible with provided LED driver.

### 2.7 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
    - c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
  - 5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
  - 7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
  - 8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.

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9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.

10. Warranty: Five (5) year warranty.

B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.

1. SW-O; Wall Switch:

a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.

b. Manufacturers:

- 1) Watt Stopper DW-100 Series
- 2) Hubbell LHMTS, Leviton OSSMT series
- 3) Sensor Switch WSX-PDT SA Series

2. SW-O2; Wall Switch:

a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.

b. Manufacturers:

- 1) Watt Stopper DW-200 Series
- 2) Hubbell LHMTD
- 3) Leviton OSSMD series
- 4) Sensor Switch WSX-PDT 2P Series

3. Sensitivity Adjustment: Separate for each sensing technology.

4. Detection Coverage:

a. Task Areas: Detect occupancy anywhere in an area based on hand motion.

b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.

C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

<b>LIGHTING LOAD</b>	<b>LOAD A</b>	<b>LOAD B</b>
<b>STEP 1:</b>	<b>ON</b>	<b>OFF</b>
<b>STEP 2:</b>	<b>OFF</b>	<b>ON</b>

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<b>STEP 3:</b>	<b>ON</b>	<b>ON</b>
<b>STEP 4:</b>	<b>OFF</b>	<b>OFF</b>

**2.8 DISTRIBUTED LIGHTING CONTROL**

- A. Manufacturers: as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.
  - 1. Acuity Controls nLight Series
  - 2. Legrand Watt Stopper DLM Series
  - 3. Hubbell Automation NX Series
  - 4. Lutron
- B. System Description: The lighting control system shall be a network of remote modules System includes all associated wiring, relay modules, photocells, switches, dimmers, time clock, occupancy sensors. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.
- C. Control Devices: All occupancy sensors (ultrasonic, IR and dual technology type), photocells, switches, and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.
- D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277-volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to four (4) relays. Relay modules shall be labeled with room number that relays control lighting within.
- E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-volt AC for tungsten filaments and 20 A, 277-volt AC for electronic ballasts, 50,000 cycles at rated capacity.

**2.9 CENTRAL LIGHTING CONTROL INTERFACES**

- A. SW-LV; Manual Switches, Stations and Plates:
  - 1. Switches: Modular, momentary pushbutton, with addressable capabilities to control the luminaires assigned to that switch. The switch shall be able to actuate the functions based on the described sequence of operation and intended functions.
  - 2. Preset/fader stations shall operate using programmable buttons and/or faders as indicated on drawings.
  - 3. Integral Pilot Light or LED: Indicate that controls are active or powered by being on continuously when powered or when pushbuttons are actuated.

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4. Labeling of buttons and faders shall be engraved/screened by manufacturer, using approved text returned with shop drawing submittals.
5. Station control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via direct or network connection. Function options include: preset selection, manual mode, record mode, station lockout, raise/lower, macro, cue, and room join/separate.

### 2.10 TIME SWITCH

- A. TC-1; Astronomical time switch, 7-day, 1 channel, electronic, one SPDT 5-amp contact, LCD display, 12 or 24-hour format, minimum 100 hours carryover, UL listed.
  1. Manufacturers:
    - a. Paragon EC71ST
    - b. Tork DWZ100A
    - c. Intermatic ET70115C

### 2.11 CONDUCTORS AND CABLES

- A. Control Wiring:
  1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 260513 "Wire and Cable."
  2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
  3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
  4. Network cabling as required by manufacturer.
- B. Splices and Taps:
  1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

## PART 3 - EXECUTION

### 3.1 PRE-CONSTRUCTION MEETING

- A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

### 3.2 EXAMINATION

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- A. Verify that surfaces are ready to receive work.
- B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. All wiring shall be installed in conduit.
- C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

### 3.4 SUPPORT SERVICES

- A. System Startup:
  - 1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.
- B. Testing:
  - 1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
  - 2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
    - a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    - b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    - c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
  - 3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
  - 4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.

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- a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
  - b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.
- C. Training:
1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
  2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.
- D. Documentation:
1. Manufacturer shall provide system documentation including:
    - a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
    - b. Drawings for each panel showing hardware configuration and numbering.
    - c. Panel wiring schedules.
    - d. Typical diagrams for each component.

### 3.5 SYSTEM COMMISSIONING

- A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 010900, General Commissioning, for further details.
- B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 010900, General Commissioning, for system verification tests and commissioning requirements.
- C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 010900, General Commissioning, for Contractor training requirements.

**END OF SECTION 26 0933**

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**SECTION 26 2000  
SERVICE ENTRANCE**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Arrangement with Utility Company for permanent electric service.
- B. Underground service entrance

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the One-Line Diagram for additional information.

**1.3 QUALITY ASSURANCE**

- A. Utility Company: Nevada Energy.
- B. Install service entrance in accordance with Utility Company's rules and regulations.

**1.4 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 260500.
- B. Submit Utility Company prepared drawings (if applicable).

**1.5 SYSTEM DESCRIPTION**

- A. System Voltage: 208Y/120 volts, three phase, four-wire, 60 Hertz.

**PART 2 - PRODUCTS**

**2.1 METERING EQUIPMENT**

- A. Meter: Furnished by the Utility Company.
- B. Meter Base: Furnished by the Contractor, as approved by the Utility Company. (Manufacturers: Milbank, Superior, Duncan, or Anchor).
- C. Metering Transformer Compartment: Furnished as part of the main switchboard to Utility Company's specifications.

**2.2 IDENTIFICATION**

- A. Provide a permanent plaque or sign denoting all services, feeders, and branch circuits supplying the building or structure and the area served by each. Install plaque or sign at each service disconnecting means.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**



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- A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
- B. Primary distribution equipment and pad-mounted transformers shall be furnished and installed by the Utility Company.
- C. Primary conductors shall be furnished, installed, and terminated by the Utility Company. Primary conduit shall be furnished and installed by the Contractor, as shown on the drawings, to the Utility Company's requirements.
- D. Underground: Install service entrance conduits in concrete envelope from Utility Company's pad mounted transformer to meter cabinet and building service entrance equipment. Utility Company will connect service conductors to transformer secondary lugs.
- E. Concrete Pad for Transformer: Furnished and installed by the Contractor to Utility Company's specifications.

**END OF SECTION 26 2000**

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**SECTION 26 2413  
SWITCHBOARDS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Main and distribution switchboards: SB-#

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

**1.3 REFERENCES**

- A. ANSI C12 - Code for Electricity Metering
- B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments
- C. ANSI C57.13 - Requirements for Instrument Transformers
- D. NEMA AB 1 - Molded Case Circuit Breakers
- E. NEMA KS 1 - Enclosed Switches
- F. NEMA PB 2 - Dead Front Distribution Switchboards
- G. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less

**1.4 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.
- B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.
- E. Submit manufacturer's instructions under provisions of Section 26 0500.

**1.5 SPARE PARTS**

- A. Keys: Furnish four each to the Owner.

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### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Section 26 0500.
- B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.
- C. Store and protect products under provisions of Section 26 0500.
- D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

### 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 260500.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Approved Manufacturers:
  - 1. Square D Class 2700 QED-2, I-Line, Powerstyle
  - 2. ABB Spectra / Evolution
  - 3. Siemens
  - 4. Eaton

### 2.2 RATINGS

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. Refer to Section 26 0553 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The switchboards for this project shall be fully rated.

### 2.3 SWITCHBOARD CONSTRUCTION AND RATINGS

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- A. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
- B. Switchboard electrical ratings and configurations as shown on the drawings.
- C. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.
- D. Main Section Devices: Individually mounted and compartmented.
- E. Distribution Section Devices: Individually mounted.
- F. Auxiliary Section Devices: Individually mounted and compartmented.
- G. Bus Material: Aluminum with tin plating, sized in accordance with NEMA PB 2.
- H. Bus Connections: Bolted, accessible from front only for maintenance. Plug-on connections may be utilized with Architect/Engineer's pre-approval by addenda.
- I. Bus bars shall be fully isolated, braced for minimum ampere rms symmetrical rating as indicated on drawings.
- J. The bus shall extend the full height of the distribution sections to provide space for future breakers.
- K. Provide a 1 X 1/4-inch copper ground bus through the length of the switchboard.
- L. Enclosure shall be NEMA PB 2; Type 1 - General-Purpose. Sections shall align at front and rear. Provide removable panel access or hinged door with flush lock and all keyed alike. Door hardware shall provide swing clear operation (180-degree swing).
- M. Switchboard Height: NEMA PB 2; 92 inches, excluding floor sills, lifting members and pull boxes.
- N. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
- O. Pull Box: Same construction as switchboard, size as shown on the drawings. Top and sides shall be removable. Insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- P. Pull Section: Same construction as switchboard, size as shown on the drawings. Depth and height to match switchboard. Arrange as shown on the drawings.
- Q. Future Provisions: In addition to the spare devices shown, provide a minimum of 15 inches of fully equipped space for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Continuous current rating as indicated on the drawings.
- R. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

### 2.4 SWITCHING, OVER-CURRENT PROTECTIVE DEVICES, AND ARC ENERGY REDUCTION

- A. Fusible Switch Assemblies (600 Amperes and Smaller): Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover

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with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class 'R' fuses, type as specified, with Class 'R' rejection clips.

- B. Fusible Switch Assemblies (800 Amperes and Larger): Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses.
- C. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide breaker interrupting ratings as indicated on the plans. Where necessary to meet interrupting ratings, breakers shall be provided with automatically resetting current limiting elements in each pole.
- D. Solid State Molded Case Circuit Breakers: (All breakers identified on plans as solid-state with 2,500 ampere frame sizes and below.) Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with a sealable clear cover. Provide stationary mounting. Ground fault sensing shall be breaker integral with circuit breaker. Provide zero sequence type ground fault sensor. Provide breaker interrupting ratings as indicated on the plans.
- E. Arc Energy Reduction with Selective Coordination:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
  - 3. The following selective coordination and arc energy reduction system options are acceptable:
    - a. Zone-selective interlocking with permanent arc energy reduction
    - b. Differential relaying with permanent arc energy reduction
    - c. Listed energy-reducing active arch flash mitigating system

### 2.5 INSTRUMENTS AND SENSORS

- A. Current Transformers: ANSI C57.13; 5 ampere secondary, bar or window type, with single secondary winding, unless otherwise required for application, and secondary shorting device, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- B. Potential Transformers: ANSI C57.13; 120-volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- C. Ground Fault Sensor: Zero sequence type.
- D. DPM; Digital AC Power Monitor: Capable of measuring, calculating and directly displaying; Volts (L-L, L-N), Amps, KW, KWH. Monitor shall be true RMS measurement with programmable set-up

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parameters. All set-up parameters data shall be stored in non-volatile memory to protect from power outages.

E. Accessories:

1. Transformer Disconnect Lockable Hasp: Provide circuit breakers, fused switches, and disconnects serving transformers with a lockable padlock hasp capable of being locked in the open/closed position.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install switchboard in locations shown on the drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch.

#### **3.2 FIELD QUALITY CONTROL**

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.
- D. Physically test key interlock systems to ensure proper function.

#### **3.3 ADJUSTING AND CLEANING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred surfaces to match original finish.
- C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.
- D. Adjust trip and time delay settings to values as scheduled, or as instructed by the Architect/Engineer.
- E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer's directions. Provide testing documentation with Operating & Maintenance Manual submittals.

**END OF SECTION 26 2413**

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**SECTION 26 2416  
PANELBOARDS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Service and distribution panelboards: DP-#, DP-#
- B. Lighting and appliance branch circuit panelboards: Panel '####'
- C. Fusible branch circuit panelboards: Panel '####'
- D. Load centers: Panel '###'

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

**1.3 REFERENCES**

- A. NEMA AB 1 - Molded Case Circuit Breakers
- B. NEMA FU 1 - Low voltage cartridge fuses
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
- G. UL 248 - Low-Voltage Fuses
- H. UL 67 - Panelboards

**1.4 SUBMITTALS**

- A. Submit shop drawings for equipment and component devices under provisions of Section 26 0500.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.
- D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.

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E. Submit manufacturer's instructions under provisions of Section 26 0500.

### 1.5 SPARE PARTS

- A. Keys: Furnish four (4) each to the Owner.
- B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type and rating installed to the Owner.
- C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

## PART 2 - PRODUCTS

### 2.1 RATINGS

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 260553 for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

### 2.2 MAIN AND DISTRIBUTION PANELBOARDS

- A. General
  - 1. Manufacturers:
    - a. Square D QMB, I-Line
    - b. ABB ReliaGear Entelleon
    - c. Siemens F2, P4
    - d. Eaton PRL4, PRL5
- B. Panelboards: NEMA PB 1; type as shown on the drawings.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with aluminum bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.



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- F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.
- G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.
- H. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- I. Fuse Clips (Switches 600 Amperes and Smaller): Provide with Class 'R' rejection clips. Fuse Clips (601 Amperes and Larger): Designed to accommodate Class 'L' fuses.
- J. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- L. Arc Energy Reduction:
  - 1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
  - 2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch in the first section of the electrical equipment.
- M. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

### 2.3 BRANCH CIRCUIT PANELBOARDS

- A. General
  - 1. Manufacturers:
    - a. Square D NQ, NF
    - b. ABB A Series
    - c. Siemens P1
    - d. Eaton PRL1, PRL2
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's

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standard gray enamel.

- E. Provide panelboards with aluminum bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.
- J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.
- K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

### 2.4 COLUMN WIDTH PANELBOARDS

- A. General
  - 1. Manufacturers:
    - a. Square D NQ, NF
    - b. ABB A Series
    - c. Siemens P1
    - d. Eaton PRL1-LX, PRL2-LX
- B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
- C. Enclosure: NEMA PB 1; Type 1.
- D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

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- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
- G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

### 2.5 FUSIBLE BRANCH CIRCUIT PANELBOARDS

#### A. General

- 1. Manufacturers:
  - a. Bussmann
  - b. Littelfuse
  - c. Siemens SQSCP
- B. Provide cabinet front with concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- C. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
- D. Overcurrent protective devices shall be UL listed, with voltage, amperage, number of poles, and short-circuit current rating as shown on the panelboard schedule. Multi-pole branch circuit protection devices shall trip on an overcurrent of any pole to prevent single-phasing of the load.
- E. Fuse holder shall be finger-safe with trim installed. Fuses shall only be removable when terminals are not energized.
- F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future fuse units.
- G. All multiple-section panelboards shall have the same dimensional backbox and cabinet front size.
- H. Minimum Integrated Short Circuit Rating: As shown on the drawings.
- I. Branch fuse disconnect shall have visible ON/OFF indication, blown fuse indicating lights, and permanently installed lockout means.

### 2.6 LOAD CENTERS

#### A. General

- 1. Manufacturers:

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- a. Square D
  - b. ABB
  - c. Siemens
  - d. Eaton
- B. Load Centers: Circuit breaker load center.
- C. Enclosure: General-Purpose.
- D. Provide pull ring and latch on door. Finish in manufacturer's standard gray enamel.
- E. Provide load centers with bus ratings as shown on the drawings.
- F. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.
- G. Molded Case Circuit Breakers: Provide plug-on circuit breakers with integral thermal and instantaneous magnetic trip in each pole, with common trip handle for all poles. Provide breaker interrupting ratings as indicated on the plans. Where necessary to meet interrupting ratings, breakers shall be provided with automatically resetting current limiting elements in each pole. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings.
- H. Do not use tandem circuit breakers.
- I. Accessories:
- 1. Transformer Disconnect Lockable Hasp: Provide circuit breakers, fused switches, and disconnects serving transformers with a lockable padlock hasp capable of being locked in the open/closed position.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.
- B. Height: 6 feet to handle of highest device.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEIPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.
- E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

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F. Install fuses in fusible switch assemblies.

### 3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

**END OF SECTION 26 2416**

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**SECTION 26 2726  
WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Device plates and box covers
- B. Modular connectors
- C. Receptacles (REC-#)
- D. Floor boxes and floor box with service fitting (FB-#)
- E. Cord and plug sets

**1.2 QUALITY ASSURANCE**

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with the Electrical Code.

**1.3 REFERENCES**

- A. DSCC W-C-896F - General Specification for Electrical Power Connector
- B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- C. NEMA WD 1 - General Color Requirements for Wiring Devices
- D. NEMA WD 6 - Wiring Devices - Dimensional Requirements
- E. NFPA 70 - National Electrical Code (NEC)
- F. UL 498 - Standard for Attachment Plugs and Receptacles
- G. UL 943 - Standard for Ground Fault Circuit Interrupters

**1.4 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.
- C. Provide a non-returnable sample of each countertop and furniture-mounted receptacle assembly as part of the submittal process.

**1.5 COORDINATION**

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.

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- B. Cord and Plug Sets: Match equipment requirements.
- C. Coordinate installation of receptacle assemblies in countertops and furniture with the Contractor providing the countertop or furniture. Contractor shall coordinate penetrations and conduit routing in countertops and furniture with drawings and other obstacles below the installation surface.

### **PART 2 - PRODUCTS**

#### **2.1 DEVICE COLOR**

- A. All switch, receptacle, and outlet colors shall be verified with Architect, unless indicated otherwise.

#### **2.2 COVERPLATES**

- A. All switches, receptacles, and outlets shall be complete with the following:
  - 1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
  - 2. Decorator Grade - Public: Decorator thermoplastic and match device color wallplates in public finished spaces where walls are finished.
    - a. Manufacturer:
      - 1) Leviton Decora
      - 2) Hubbell Decorator
      - 3) Cooper Decorator
      - 4) or approved equal
    - 3. #302 stainless steel coverplates in unfinished spaces for flush boxes.
    - 4. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.
  - B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
  - C. Install nameplate identification as indicated in Section 26 0553.
  - D. Plate securing screws shall be metal with head color matching the wall plate finish.

#### **2.3 RECEPTACLES**

- A. Refer to Electrical Symbols List for device type.
- B. Devices that are shaded on the drawings shall be red.
- C. Devices that are shaded on the drawings shall be red and shall have an illuminated face or indicator light to indicate that there is power to the device.
- D. REC-DUP: NEMA 5-20R Duplex Receptacle:

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1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.
    - a. Manufacturers:
      - 1) Hubbell 5352A
      - 2) Leviton, 5362-S
      - 3) Pass & Seymour 5362
      - 4) Cooper 5352
  2. Heavy Duty: 125-volt, 20 amp, 3-wire grounding type heavy duty industrial grade with impact resistant thermoplastic face and one-piece brass back strap with integral ground contacts.
    - a. Manufacturers:
      - 1) Hubbell 5362
      - 2) Leviton 5362
      - 3) Pass & Seymour 5362A
      - 4) Cooper AH5362
- E. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.
    - a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    - b. Manufacturers:
      - 1) Hubbell GF20L
      - 2) Leviton GFNT2
      - 3) Pass & Seymour 2097
      - 4) Cooper SGF20
- F. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use clear cover.
  2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    - a. Manufacturers:



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- 1) Hubbell:
    - (a) GFTWRST20 with clear housing RW57300
    - (b) GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
  - 2) Leviton GFWT2 with clear housing 5977-CL
  - 3) Pass & Seymour 2097TRWR with clear housing WIUC10-C
  - 4) Cooper WRS GF20 with clear housing WIU-1
- G. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:
1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.
    - a. Manufacturers:
      - 1) Refer to Duplex Receptacle above.
- H. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- I. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- J. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.
- K. Isolated ground receptacles shall have the equipment ground contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from the mounting strap.
- L. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

### 2.4 FLOOR BOXES

- A. Cover Color and Style: Verify with Architect from manufacturer standard options.
- B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.
- C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:
  1. Slab on Grade: Cast Iron or listed for slab on grade with special kit, coating ,or equivalent; corrosion resistant.
  2. Elevated Slab: Cast Iron,
  3. Raised Access Floor, Cast-in-Place, or Access Floor Panels: Stamped steel.
  4. Wood Floor, not Cast-in-Place: Stamped steel and rated for wood floor application.
- D. FB-#: Custom Convention Center Style Utility Box:

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1. Custom Convention Center Style Utility Box, square/rectangular flush-mounted hinged cover, center service area with closed while-in-use cover and cable egress doors in cover, provide complete with appropriate outlet cover plates and hardware. For use with on grade concrete pour floors, 30,000 lbs load capacity, fully adjustable, UL 514 scrub water listed, corrosion resistant housing listed for on-grade applications.
2. Manufacturers: Hubbell Convention Center Utility Box HBLSCUB Series.
3. Installation: Group route raceway conduits under slab to nearest wall or as shown on plans. Provide hub reducers when applicable.

### 2.5 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  1. Cord: Rubber-insulated, stranded copper conductors, with Type SOW-A jacket; with green insulated grounding conductor and equipment rating ampacity plus a minimum of 30 percent.
  2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection, FS/UL listed.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.
- B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.
- C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacle outlets rated 21 - 50 amps single phase and 21-100 amps three phase in the following locations, as shown on drawings, or required by adopted code:
  1. Bathrooms, locker rooms, shower rooms
  2. Kitchens
  3. Rooftops
  4. Interior/Exterior locations subject to damp/wet conditions
  5. When located within 6 feet of sinks, bathtubs, and shower stalls
  6. Garages, accessory buildings, service bays
- D. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted

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code.

1. Dwelling units, dormitory units
  2. Guest rooms and suites
  3. Childcare, preschool, elementary, middle, high school, educational facilities
  4. Business Office: Corridors, waiting rooms, common areas
  5. Public Buildings: Corridors, waiting rooms, common areas
  6. Assisted living
- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.
- F. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- I. Install devices and wall plates flush and level.
- J. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 0553 - Electrical Identification.
- K. Test receptacles for proper polarity, ground continuity and compliance with requirements.
- L. Healthcare devices shall be tested in accordance with NFPA 99 6.3.3 for grounding, voltage, and impedance measurements.
- M. Floor Box Installation:
1. Set boxes level and flush with finish flooring material.
  2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
  3. Provide a minimum horizontal offset of 24 inches between boxes.
  4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

**END OF SECTION 26 2726**

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**SECTION 26 2813  
FUSES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Fuses

**1.2 REFERENCES**

- A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types
- B. UL 198E - Class R Fuses
- C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)
- D. NEMA FU 1 - Low Voltage Cartridge Fuses
- E. NFPA 70 - National Electrical Code (NEC)

**1.3 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.

**1.4 EXTRA MATERIALS**

- A. Provide two fuse pullers.
- B. Provide three of each size and type of fuse installed.

**1.5 PROJECT CONDITIONS**

- A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS - FUSES**

- A. Bussman, Division of Eaton
- B. Edison Fuse, Division of Cooper Industries
- C. Mersen
- D. Littelfuse Inc

**2.2 FUSES**

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

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- C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.
- D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.
- E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.
- F. Control transformer fuses: Class CC (time delay).
- G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install fuses where indicated on the drawings and specifications.
- B. Install fuses in accordance with manufacturer's instruction.
- C. Install fuses in packaged equipment as required by equipment manufacturer.
- D. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- E. Install spare fuse cabinet in the Main Electrical Room.

**END OF SECTION 26 2813**

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**SECTION 26 2816  
DISCONNECT SWITCHES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Fusible switches
- B. Non-fusible switches
- C. Molded case circuit switches
- D. Molded case switches
- E. Motor disconnect switch
- F. Mechanically interlocked disconnect
- G. Enclosures

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the Disconnect and Starter Schedule for rating and configuration.

**1.3 REFERENCES**

- A. NEMA KS 1 - Enclosed Switches

**1.4 SUBMITTALS**

- A. Submit product data under provisions of Section 26 0500.
- B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
- C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

**1.5 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

**PART 2 - PRODUCTS**

**2.1 FUSIBLE AND NON-FUSIBLE SWITCHES**

- A. Acceptable Manufacturers:

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1. Square D 3110 Series
  2. Eaton DH Series
  3. ABB TH Series
  4. Siemens HNF / HF Series
- B. FDS-#; Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.
- C. DS-#; Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- D. Enclosures: Type as indicated on the disconnect schedule.
- E. Accessories: As indicated on the disconnect schedule.

### 2.2 MOLDED CASE CIRCUIT BREAKERS AND SWITCHES

- A. Acceptable Manufacturers:
1. Square D
  2. Eaton
  3. ABB
  4. Siemens
- B. CB-#; Molded Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
1. Thermal Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip settings.
  3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t responses.

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4. Current Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
- C. CB-#; Molded Case Switches: Molded case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Accessories: As indicated on the disconnect schedule.

### 2.3 MOTOR DISCONNECT SWITCH

- A. Acceptable Manufacturers:
  1. Square D 3110 Series
  2. Eaton r5 Series
  3. ABB ML Series
  4. Siemens LBR Series
- B. MD-#; Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: Type as indicated on the Disconnect Schedule.
- D. Ground lug connection provided in enclosure.
- E. Accessories: As indicated on the Disconnect Schedule.
- F. Listed UL 508 suitable for motor control.

### 2.4 MECHANICALLY INTERLOCKED DISCONNECT

- A. Acceptable Manufacturers:
  1. Disconnect
    - a. Square D 3110 Series
    - b. Eaton DH Series
    - c. ABB TH Series
    - d. Siemens HF Series
  2. Receptacle
    - a. Crouse-Hinds Arktite
    - b. Appleton Powertite



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- B. DSS-#; Switch and Plug Assemblies: Rated for making and breaking loads, enclosed switch with externally operable interlock to prevent disconnecting receptacle with switch in ON position or inserting receptacle in ON position. Padlock lockable provision to meet OSHA lockout/tagout regulations.
- C. Enclosures: Type as indicated on the Disconnect Schedule.
- D. Ground lug connection provided in enclosure.
- E. Accessories: Matching male pin and sleeve plug, two auxiliary/pilot contacts. As indicated on the Disconnect Schedule.
- F. Listed UL 2682 suitable for motor disconnect.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install disconnect switches where indicated on the drawings.
- B. Install fuses in fusible disconnect switches.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

#### **3.2 ELEVATOR SERVICE DISCONNECT SWITCH**

- A. Coordinate installation with elevator requirements and contractor.
- B. Coordinate installation with fire alarm contractor.

#### **3.3 MOBILE DIAGNOSTICS SERVICE DISCONNECT**

- A. Coordinate installation with mobile medical equipment requirements and vendor.

#### **3.4 ADJUSTING**

- A. Set field-adjustable circuit breaker trip ranges.

**END OF SECTION 26 2816**

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**SECTION 26 3213  
PACKAGED ENGINE GENERATOR SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Packaged engine generator system
- B. Remote annunciator panel
- C. Battery and charger
- D. Integrated on-board generator paralleling control
- E. Weatherproof enclosure

**1.2 REFERENCES**

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers
- C. ANSI/NEMA MG 1 - Motors and Generators
- D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
- E. NFPA 70 - National Electrical Code (NEC)
- F. NFPA 110 - Standard for Emergency and Standby Power Systems
- G. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- H. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines
- I. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

**1.3 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 26 0500.
- B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
- C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.

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1. Include work clearance and equipment access information. Clearly identify required equipment access locations for installation, maintenance, testing, and repair.
- D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.
- E. Submit manufacturer's installation instructions under provisions of Section 26 0500.
- F. Submit complete control and operation sequences for on-board paralleling system.

### 1.4 EXTRA MATERIALS

- A. Submit maintenance materials under provisions of Section 26 0500.
- B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.
- C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.
- D. Provide one fuse for every type and rating used.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 0500.
- B. Store and protect products under provisions of Section 26 0500.
- C. Accept packaged engine generator set and accessories on site in crates and verify damage.
- D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

### 1.6 SYSTEM DESCRIPTION

- A. Engine generator system to provide source of emergency and standby power.
- B. System Capacity: 200KW, 250KVA, at specified voltage dip, at an elevation of 4600feet above sea level, and ambient temperature between -20°F and 110°F; standby rating using engine-mounted radiator.
- C. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class 2 Level 1.
- D. Operation: In accordance with ANSI/NFPA 110.

### 1.7 COORDINATION DRAWINGS

- A. Reference Coordination Drawings article in Section 260500 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

### 1.8 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 260500.

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- B. Accurately record location of engine generator and mechanical and electrical connections.

### 1.9 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 260500.
- B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

### 1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.
- B. Manufacturer: Company with minimum five (5) years of documented on-board paralleling system experience.
- C. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

### 1.11 WARRANTY

- A. Provide a five (5) year warranty under provisions of Section 26 0500.

### 1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Caterpillar.
- B. Cummins Power Generation.
- C. Kohler.
- D. MTU On Site Energy.

### 2.2 PACKAGED ENGINE-GENERATOR SET (GEN-)

- A. Packaged engine-generator set shall be a coordinated assembly of compatible components. Stationary generators shall be listed.
- B. Safety Standard: Comply with ASME B15.1 and UL 2200.

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- C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.
- D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.
- E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

### 2.3 ENGINE

- A. Type: Water-cooled in-line or V-type, four-stroke cycle spark-ignition compression ignition diesel electric ignition internal combustion engine.
- B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.
- C. Fuel: Appropriate for use of B10 biodiesel.
- D. Engine Speed: 1800 RPM.
- E. Governor: Isochronous type with speed sensing.
- F. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- G. Frequency Response:
  - 1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
  - 2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.
- H. Fuel System: Engine mounted diesel fuel pump and relief-bypass valve.
- I. Fuel Supply System:
  - 1. DT-; Day Tank: UL 142 listed fuel tank with hour rated capacity. Integral rupture basin with 150% of nominal capacity and leak detection. Dual integral self-priming pumps and level control with indication. Low-level sensor at 25% with alarm and contacts. High-level sensor with alarm, contacts, and redundant fuel shutoff. Include flexible fuel line connections for all supply and return lines as indicated on the Mechanical drawings. Provide with emergency vent cap.
    - a. Manufacturers:
      - 1) Simplex

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2) Tramont

3) Pyrco

J. Fuel Polishing System:

1. Fuel polishing system capable of removing 99% of emulsified water and particulate down to 3 microns from the fuel. The system shall be sized so the stored fuel capacity shall be polished at least once per week. The system shall include a pump to circulate the fuel from the storage tank through the filter/separator and return it to the tank, A gauge or alarm shall provide notification when a filter is due for change. A timer shall be set to run the pump during off peak hours.

K. Lubrication System: Engine or skid mounted filter and strainer, thermostatic control valve capable of full flow and designed to be fail safe, and crankcase drain arranged for gravity drainage with siphon or pump.

L. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 208-1Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.

M. Cooling System: Closed loop, liquid cooled, with remote radiator and integral engine-driven coolant pump.

1. GRR-; Remote Radiator: Vertical air discharge. Multiple belt drive from totally enclosed sealed bearing motor. Sized by generator manufacturer.
2. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
3. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
4. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.

N. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:

1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
4. BC-# Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter,

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and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.

- O. Exhaust System: Critical type silencer (85 dBA max at 10 feet) Industrial type silencer (20 to 75 Hz frequency range; 87 dBA max at 25 feet), side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Silencer shall include a threaded opening for connection of ¾" drain line. Opening shall be flush on inside of silencer.
- P. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.
- Q. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.
- R. Mounting: Provide unit with suitable spring-type vibration isolators.

### 2.4 GENERATOR

- A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.
- B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.
- C. Insulation: ANSI/NEMA MG 1, Class H.
- D. Temperature Rise: 105°C 80°C continuous.
- E. Enclosure: ANSI/NEMA MG 1; open drip-proof.
- F. Voltage Regulation:
  - 1. The maximum instantaneous voltage dip (IVD) shall be 30 percent for building loads and 15 percent for the fire pump.
  - 2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation  $\pm 1$  percent from no load to full load. Include manual controls to adjust voltage drop  $\pm 5$  percent voltage level, and voltage gain.
- G. Subtransient Reactance ( $X'd$ ): Maximum 15 percent.
- H. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

### 2.5 CONTROLS AND INDICATION

- A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

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- B. Ground Fault: Provide ground fault sensing at the generator. The sensor shall be located ahead of the generator service disconnect. Provide a ground fault indication on the engine-generator control panel. Provide an instruction nameplate at the control panel.
  - 1. Instruction nameplate: Provide operational instructions for a ground fault indication as approved by the local Authority Having Jurisdiction.
- C. GCP-; Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
  - 1. Alarm indication as required by NFPA 110 for a Level 1 system.
  - 2. AC frequency meter.
  - 3. AC output voltmeter with phase selector switch.
  - 4. AC output ammeter with phase selector switch.
  - 5. Output voltage adjustment.
  - 6. DC voltmeter (alternator battery charging).
  - 7. Engine start/stop selector switch.
  - 8. Engine running time meter.
  - 9. Oil pressure gauge.
  - 10. Engine coolant temperature gauge.
  - 11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
  - 12. Fuel derangement alarm.
  - 13. Generator overload.
  - 14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
  - 15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
  - 16. Ground fault indication.
  - 17. Generator control and start signal failure.
  - 18. On-board paralleling controls.
  - 19. 80% load alarm.
  - 20. Key switch, three-position selection switch.



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- D. GANN-; Remote Engine Annunciator Panel: ANSI/NFPA 99 and NFPA 110 for a Level 1 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a surface mounted panel with brushed stainless steel finish. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. The remotely reported alarms shall include the following.
1. Overcrank
  2. Low water (engine) temperature
  3. High engine temperature pre-alarm
  4. High engine temperature
  5. Low lube oil pressure pre-alarm
  6. Low lube oil pressure
  7. Overspeed
  8. Low fuel main tank
  9. Low coolant level
  10. Not in auto
  11. Emergency Power Supply (EPS) supplying load
  12. High battery voltage
  13. Low battery voltage
  14. Battery charger failure (includes AC failure)
  15. Generator running
  16. Normal utility power
  17. Emergency stop
  18. Rupture basin alarm
  19. Emergency Power Off Switch activated (EPO)
  20. Alarm for power supply or UPS serving motorized breakers
  21. Generator control and start signal failure.
  22. On-board paralleling controls.
  23. 80% load alarm.
- E. Building Automation System Integration:

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1. Provide a terminal block to allow the Facility Monitoring and Control System (FMCS) to report generator alarms. Provide individual terminal points for each of the annunciator alarms and pre-alarms. Provide an additional terminal point to combine all generator alarms under a single terminal point. Provide a permanent label for each terminal point. Each terminal will provide a binary output for the FMCS to read. Refer to Section 230900 for alarms reported by the FMCS.

### 2.6 ON-BOARD GENERATOR PARALLELING CONTROLS

- A. Provide microprocessor based integral generator on-board paralleling control system with automatic generator start, paralleling, load sequence control and load shed, system monitoring, and overcurrent-overload protection.
  1. Provide on-board paralleling system control and display at each individually packaged generator. The failure or off status (Run-Off-Auto) of a single generator shall not prevent operation of the other package engine generators and paralleling system.
  2. The control shall be capable of paralleling with other generators with the same on-board generator paralleling control platform.
  3. The controller shall support onboard synchronization of voltage, frequency, and phase rotation between parallel generator sources. The controller shall allow both automatic synchronization and close to the bus and manual close to the bus when systems are synchronized. The automatic synchronization feature shall include a first-available feature to close the first generator to the bus.
  4. Load Share: Provide electronic load sharing of KW, KVAR load between generators connected to the emergency bus without frequency droop.
  5. The controller shall directly communicate with the over current protection device or contactor switch to connect individual generators to the emergency bus.
- B. Load Management: Provide electronic programmable load management for individual transfer switches and loads. Refer to the emergency power system sequence of operation schedule for the quantity of required individual control steps, load shed relays, and control steps.
- C. Graphical User Interface and Display per Individually Packaged Generator:
  1. Master Run-Off-Auto control
  2. Emergency Stop Switch
  3. Master Alarm, Alarm Silence, Reset, Lamp Test Button
  4. Generator status, Generator Circuit Breaker close/trip status
  5. Runtime, Start counter
  6. System Parameter Display: Bus line-line voltage, bus line-neutral voltage, KW, KVAR, KVA, frequency, power factor
  7. Historical event logging of system starts, stops, warnings, alarms, and failures. Provide capability to extract historical log information from the controller via communication port or electronic storage (example USB drive).

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### D. Environmental Conditions:

1. Ambient Temperature: -20°C to 50°C, non-condensing for humid conditions
2. Graphical User Interface and Display: IP65 or better

## 2.7 ACCESSORIES

A. Generator Circuit Breaker: Molded or insulated case, service-rated electronic trip type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator is shut down by other protective devices.
4. Mounting: Provide freestanding enclosure or mount integrally with control and monitoring panel.
5. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.
6. Arc Energy Reduction: Provide and arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy system shall be provided for overcurrent protection devices rated 1,200 amps or larger.

B. EPO; Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at each generator annunciator panel.

C. Remote Fuel Fill Station (RFFS-#): Provide a remote fuel fill station including a fill port within a surface-mounted, lockable, NEMA 3R stainless steel construction with gasketed hinged door and lockable handle. The fill port shall have a minimum overflow holding capacity of five (5) gallons. The fill port inside the cabinet shall be field coordinated. Provide dust cover for fill connection. Include local light and horn alarm with test switch and silence feature when tank level is above 95 percent full. Provide additional float switch in tank for level indication. Include the following accessories:

1. Solenoid valve to prevent additional fuel delivery to the tank when full; 120-volt power provided by Contractor.
2. Lockable drain valve for overflow.
3. Local analog gauge of main tank fuel level.
4. Local digital gauge of main tank fuel level.

D. Dual Source Fuel Filter:

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1. High volume, selectable dual path, minimum two high-capacity filters, with water separation, and remote monitor / alarm.
  2. Operation Functionality: Selectable path, primary and standby filter. Ability to switch between filters, replace filters, and bleed filters during generator operation.
  3. Remote monitor / alarm feature wired to generator control and annunciator panel.
- E. Provide dual redundant engine starters. The redundant engine starters shall be configured to start the engine when the primary engine starter fails.

### 2.8 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

- A. Prefabricated or pre-engineered skintight enclosure with the following features:
1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
  2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
  3. Structural Design and Anchorage: Wind resistant up to 100 mph.
  4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays. Louvers shall not extend outside main generator enclosure.
  5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
  6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
  7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.
  8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
  9. The exhaust system silencer shall be installed within the enclosure housing.

### 2.9 OUTDOOR GENERATOR-SET ENCLOSURE WALK-IN

- A. Prefabricated or pre-engineered walk-in enclosure with the following features:

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1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points.
2. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays. Louvers shall not extend outside main generator enclosure.
5. Hinged doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.
8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.
10. Electrical:
  - a. A 100-amp, 3 phase, 4 wire 208/120-volt panelboard shall be factory furnished and installed. Panel shall include circuit breakers for all non-life safety electrical loads.
  - b. Provide electric unit heater inside enclosure with adjustable thermostat and disconnect switch. Heater shall maintain a minimum interior temperature of 40 °F.
  - c. Provide conduit and wiring for all non-life safety loads: unit heater, engine jacket water heater, battery charger, louver motors, non-life safety lights, receptacles, etc.
  - d. Provide life safety devices (1/3 of the fluorescent vapor tight lights, light switches, 1/2 of the receptacles and emergency lighting units), conduit and wiring to a single junction box for connection to life safety circuit by electrical contractor. Emergency receptacles and switches shall be red.

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- e. Lighting shall be compact fluorescent vapor tight units with cold weather ballasts. Lighting shall allow for a uniform light level of (30) footcandles minimum on work surfaces. Normal and life safety lights shall be light switched separately. Provide two incandescent emergency lights connected to the generator starting batteries.

### 11. Manufacturers:

- a. Robinson Enclosures
- b. Lectrus/DTS
- c. International Supply Co. (ISCO)
- d. Chillicothe Metal Co.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.
- B. Verify that required utilities are available in proper location and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker.
- C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

### **3.3 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Section 260500 and in compliance with NFPA 110 requirements.
- B. Provide portable test bank for full load test, if required. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
- C. Fill fuel tank prior to start of test.
- D. The on-site installation test shall be conducted as follows:
  - 1. With the prime mover in a "cold start" condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.

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2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
3. The time delay on start shall be observed and recorded.
4. The cranking time until the prime mover starts and runs shall be observed and recorded.
5. The time taken to reach operating speed shall be observed and recorded.
6. The voltage and frequency overshoot shall be recorded.
7. The time delay on transfer to emergency power for each switch shall be recorded. Life safety and critical branch transfer switches must transfer within 10 seconds.
8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
9. The voltage, frequency, and amperes shall be recorded.
10. The prime mover oil pressure and water temperature shall be recorded, where applicable.
11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
12. When primary power is returned to the building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.
13. The time delay on the prime mover cool down period and shutdown shall be recorded.
14. Allow prime mover to cool for 5 minutes.
15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.
17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:
  - a. Kilowatts
  - b. Amperes
  - c. Voltage
  - d. Frequency
  - e. Coolant temperature
  - f. Enclosure temperature (interior)

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- g. Oil pressure
  - h. Engine exhaust temperature
  - i. Engine inlet temperature
  - j. Oil Temperature
  - k. Battery charge rate
18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.
- a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.
  - b. The control switch shall be set at "run" to cause the prime mover to crank.
  - c. The complete crank/rest cycle shall be observed and recorded.
19. Test alarm and shutdown circuits by simulating conditions.
- E. Contractor shall fill fuel tanks upon completion of test.
  - F. Testing documentation shall be submitted to the Architect/Engineer for review and approval. Reviewed documentation shall be submitted to IDPH as part of the project close-out certification package.
  - G. Generator testing worksheets are included with this specification section.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare, start, test, and adjust systems under provisions of Section 260500.
- B. Provide UL field inspection of generator.

### 3.5 COMMISSIONING: ON-BOARD GENERATOR PARALLELING CONTROL

- A. Prepare, start, test, and adjust systems under provisions of Section 260500. The on-board paralleling startup, testing, and commissioning may be conducted with other startup, testing, and commissioning requirements of this specification.
- B. Provide on-site manufacturer representative for on-board generator paralleling system startup, testing, and commissioning.
- C. Simulate a utility power loss test of the EPSS and on-board generator paralleling control system.
  - 1. Refer to the emergency power system sequence of operation schedule on the drawings.
  - 2. Report and document deviations from the sequence of operation schedule, system adjustments, and deficiencies.
  - 3. Obtain and Submit Authority Having Jurisdiction AHJ observation and certificate of acceptable emergency power system operation when required for facility occupancy certificate.



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### 3.6 ADJUSTING

- A. Adjust generator output voltage and engine speed.

### 3.7 CLEANING

- A. Clean work under provisions of Section 260500.
- B. Clean engine and generator surfaces. Replace oil and fuel filters.

### 3.8 DEMONSTRATION

- A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Architect/Engineer.
- B. Describe loads connected to emergency and standby systems and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

**END OF SECTION 26 3213**

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**SECTION 26 3353  
STATIC UNINTERRUPTIBLE POWER SUPPLY**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Static uninterruptible power supply UPS-# with battery energy storage.
- B. On-line battery monitoring system for static uninterruptible power systems

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the One-Line Diagram for ratings configuration.

**1.3 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in UPS equipment and battery systems with three (3) years documented experience.
- B. Operate system for 24 hours at full load before shipping.

**1.4 REFERENCES**

- A. ANSI/IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications
- B. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. IEEE C62.41 - Recommended Practice for Surge Withstand ability,
- D. NEMA PE 1 - Uninterruptible Power Systems Standard.
- E. UL 1778 - Standard for Uninterruptible Power Supply Equipment.

**1.5 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 26 0500.
- B. Provide battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and airflow requirements.
- C. Submit product data for major components, such as batteries. Include catalog sheets and technical data sheets to indicate physical data and electrical performance.
- D. Submit manufacturer's installation instructions under provisions of Section 26 0500.
- E. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.
- F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

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### 1.6 SPARE PARTS

- A. Provide spare parts under provisions of Section 26 0500.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 26 0500.
- B. Store and protect products under provisions of Section 26 0500.
- C. Protect equipment from extreme temperature and humidity by storing in a conditioned space.
- D. Protect equipment from dust and debris by wrapping unit in dust-tight cover and storing away from construction activity.

### 1.8 SYSTEM DESCRIPTION

- A. System Configuration: Continuous duty on-line rectifier and inverter. Single module with integral static switch and batteries. Internal static switch .
- B. Components: System includes batteries and battery disconnect switch; regulated solid state rectifier/charger; static transistorized pulse width modulated inverter; SCR type static transfer switch with isolation and wraparound breakers; maintenance bypass switch; filters, and breakers; monitors, sensors, and control equipment and circuits. Rectifier/charger shall be a draw-out modular design to permit safe and fast removal and replacement.
- C. Design Standards: In accordance with ANSI/IEEE 446, IEEE C6.41, and UL 1778.
- D. Utility Power Available: Rectifier/charger supplies load through inverter and maintains battery in fully-charged "float" condition.
- E. Utility Power Failure: Load supplied from battery through static inverter if utility power drops below preset limits, or fails. There is no output disturbance transmitted to load.
- F. Utility Power Returns: Rectifier/charger supplies power to load through inverter while it recharges battery. There is no output disturbance transmitted to load.
- G. Rectifier/Charger or Battery Failure: Static switch transfers load to synchronized utility power, without disturbance, when inverter output deviates beyond specified quality limits. When inverter output returns to acceptable operation, it is synchronized to utility power, and after preset timing interval, static switch returns load to inverter without disturbance.
- H. Overload or Short Circuit: Static switch transfers load to utility power during load inrush and clearing of faulted branch circuits; load automatically transfers back to inverter without disturbance.
- I. Inverter Failure: Static switch transfers to utility power without disturbance, and remains until manually returned.
- J. Maintenance Operation: Manual load transfer to utility power using bypass switch. During bypass mode, operation of system or static switch does not affect power to load.

### 1.9 PROJECT RECORD DOCUMENTS

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- A. Provide installation, and maintenance manuals under provisions of Section 26 0500.

### 1.10 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 260500.
- B. Include description of operation and servicing procedures; field testing procedures; list of major components; recommended remedial and preventive maintenance procedures; spare parts list.

### 1.11 ENVIRONMENTAL REQUIREMENTS

- A. The UPS shall be designed for indoor installation with ambient temperatures from 32°F-104°F , 77°F  $\pm 5^{\circ}\text{F}$  for the battery, and relative humidity from 0%-95% (non-condensing).
- B. The UPS shall be designed for operation at an altitude of up to 4400 feet without derating.

### 1.12 WARRANTY

- A. Warranty: Warranty shall be no less than 12 months after startup. Include coverage of travel, labor, parts, and service.
- B. Battery: Provide battery cell manufacturer 5-year warranty passed through to the end user, pro-rated after the first year on a straight-line basis.

### 1.13 MAINTENANCE SERVICE

- A. Furnish service and maintenance of uninterruptible power supply for one (1) year from Date of Substantial Completion.
- B. Include coverage of travel, labor, parts, and service.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS - STATIC UNINTERRUPTIBLE POWER SUPPLY

- A. Vertiv (Liebert)
- B. Eaton Corporation 93PM series Powerware
- C. Schneider Electric
- D. Mitsubishi Electric Power Products, Inc.

### 2.2 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

- A. System Continuous Rating: As shown on the drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from full load to no-load.
- B. Battery Capacity: Capable of operating at full load for 5 minutes.
- C. Input Voltage Limits: +10 percent/-15 percent without battery discharge.
- D. Input Frequency: 60  $\pm 6$  Hertz.

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- E. Input Current Limit: Adjustable to maximum of 120 percent of that required to operate at full load with battery bank on float charge.
- F. Current Walk-In: 25 to 100 percent in 30 seconds (programmable).
- G. UPS Power Factor Over Full Range of Loads and Input Voltages: 0.99 lagging.
- H. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
- I. Output Voltage Regulation:
  - 1.  $\pm 0.5$  percent for balanced load, full range of DC input and no load to full load variations.
  - 2.  $\pm 2$  percent for 50 percent unbalanced load, full range of DC input and no load to full load variations.
  - 3.  $\pm 5$  percent during maximum overload of the system.
- J. Output Voltage Adjustment:  $\pm 5$  percent.
- K. Output Free Running Frequency: 60 Hertz  $\pm 0.1$  percent.
- L. Frequency Adjustment:  $\pm 2$  Hertz.
- M. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into a linear load.
- N. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer to and From Bypass Line:
  - 1.  $+8, -10$  percent for a maximum of 8.3 milliseconds.
  - 2.  $\pm 5$  percent for a maximum of 25 milliseconds.
  - 3.  $\pm 3$  percent for a maximum of 50 milliseconds.
  - 4. Recovery to steady state within 100 milliseconds after any out-of-tolerance variation.
- O. Phase Displacement:
  - 1.  $120 \pm 1$  degree for balanced loads.
  - 2.  $120 \pm 4$  degrees for 50 percent unbalanced loads.
- P. Three-phase Overload Ratings:
  - 1. 1000 percent for 10 ms; via static switch.
  - 2. 110 percent continuous.
- Q. Output Current Limit: 110 percent of rated output current.

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- R. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.
- S. Efficiency: 96 percent at full load. 96.5 percent @ 50% load.
- T. Surge Protection: IEEE 587, Class A & B.

### 2.3 PHYSICAL CHARACTERISTICS

- A. All materials of the UPS shall be new, of current manufacture, high grade and free from all defects and shall not have been in prior service, except as required during factory testing. All active electronic devices shall be solid-state. All power semi-conductors shall be hermetically sealed. All relays and semi-conductors shall be dust-tight.
- B. Wiring: Wiring practices, materials and coding shall be in accordance with the requirements of the Electrical Code, OSHA, and applicable local codes and standards. All bolted connections of bus bars, lugs, and cables shall be in accordance with requirements of the Electrical Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked.
- C. All power, control, and printed circuit components shall be mounted in bolt-on and/or swing-out type assemblies for ease of maintenance and replacement. Replacement of components shall not require the use of a soldering iron.
- D. Construction and Mounting: The UPS shall be NEMA Type 1 enclosures, designed for floor mounting. The UPS shall be structurally adequate and have provisions for hoisting, jacking, and forklift handling. Wire runs shall be protected in a manner which separate power and control wiring. Provisions shall be protected in a manner which separate power and control wiring. Provisions shall be made in the cabinets to permit installation of input, output, and external control cabling, using raceway or conduit.
- E. Ventilation: Adequate ventilation shall be provided to ensure that all components are operated within environmental ratings. Cooling fans shall be redundant. All fans are to be equipped with fan failure sensors connected to an alarm on the UPS control panel.
- F. Temperature sensors shall be provided to monitor UPS internal temperature. Upon detection of temperatures in excess of manufacturer's recommendations, the sensors shall cause audible and visual alarms to be sounded on the UPS control panel. A separate room ambient temperature sensor shall be provided to give an alarm if the temperature of the inlet air to the UPS is above specified limits.

### 2.4 RECTIFIER/CHARGER

- A. The term rectifier/charger shall denote the solid-state equipment and controls necessary to convert AC to regulated DC for input to the inverter and for charging the battery.
- B. Battery Charge Current Limiting: The rectifier/charger shall be equipped with a battery charge current limit circuit that shall limit battery charging to an adjustable level of 2% to 25% of full rectifier input current. The circuit shall have a second adjustment to provide greater limiting when signaled by the emergency generator. This circuit shall allow input power limiting but shall not cause battery discharge when a low AC input voltage condition occurs. Battery charge current limit is to be set at 15% for normal operation and 2% for "generator" operation. Electrical Contractor shall make required connections to generator.

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- C. Input Current Walk-In: The rectifier/charger shall provide feature which upon AC power return to the AC input bus, after the UPS has been operating on battery power or has been de-energized, limits the total initial power requirement at the input terminals to 20% of rated load, and gradually increases power to 100% of full rating over the 15-second time interval.
- D. Fuse Failure Protection: Semi-conductors in the rectifier/charger shall be fused with fast-acting fuses so that loss of any semi-conductor shall not cause cascading failures. All fuses shall have a blown fuse indicator with an alarm light on the control panel.
- E. Output Filter: The rectifier/charger shall have an output filter to minimize ripple current into the battery. Under no conditions shall ripple current into the battery exceed 2% RMS. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter. The inverter shall be able to operate from the rectifier with the battery disconnected.
- F. Battery Recharge: In addition to supplying power for the load, the rectifier/charger shall be capable of recharging the battery as specified herein. The charging rate shall be sufficient to restore the battery from discharge to 95% charge within ten (10) times the discharge time. After the battery is recharged, the rectifier/charger shall maintain the battery at full charge until the next emergency operation.
- G. Battery Equalize Charge: An automatic equalize charge timer feature shall be provided to automatically apply an equalize voltage to the battery after a 5 second or longer utility outage. The duration of equalize charge time shall be adjustable from 0-72 hours. Manual override shall be provided for the automatic equalize circuit.
- H. Over-voltage Protection: There shall be DC over-voltage protection so that if the DC voltage raises to the pre-set limit, the UPS is to shut down automatically and the load transferred to the bypass line uninterrupted.

### 2.5 INVERTER

- A. The term inverter shall denote the equipment and controls to convert DC from the rectifier/charger or battery to precise AC to power the load. The inverter shall be solid-state, capable of accepting the rectifier/charger or battery output and providing rated output. The inverter is to be power SCR type,.
- B. Overload Capability: The inverter shall be able to sustain an overload across its output terminals up to 150% for 30 seconds without reducing output voltage. The inverter shall be capable of at least 300% current for short circuit conditions. If the short circuit is sustained, the inverter shall shut down and disconnect automatically from the critical load bus.
- C. Output Frequency: Output frequency of the inverter shall track the static bypass source provided source frequency maintains  $60 \text{ Hz} \pm 0.5 \text{ Hz}$  to maintain synchronous operation for automatic transfers. If the bypass source fails to maintain proper frequency then control shall revert to an internal oscillator. The oscillator shall be temperature compensated and hold the inverter output frequency to  $\pm 0.1\%$  for steady-state and transient conditions. Drift shall not exceed 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1% from the rated frequency.
- D. Phase Balance: Electronic controls must be used to provide individual phase voltage compensation to obtain phase balance under all conditions including up to 50% load unbalance.

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- E. Internal Protection: Fault sensing and static isolation shall be part of the inverter as well as an output circuit breaker for removal of a faulted module from the load, without affecting the critical load but beyond the stated limits.
- F. Fuse Failure Protection: Semi-conductors in the inverter shall be fused with fast acting fuses to prevent cascading failures. Each fuse shall be provided with blown fuse indicator with an alarm light on the control panel.
- G. Output Filter: The inverter shall have an output filter to maintain the total harmonic distortion (THD) of the output voltage to the specified limits.

### 2.6 SYSTEM PROTECTION

- A. Built-in Protection: Against surges, sags, and over-current from the AC source, over-voltage and voltage surges from output terminals of paralleled sources, and load switching and circuit breaker operation in the distribution system.
- B. The UPS shall be protected against sudden changes in output load and short circuits at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions.
- C. Fast-acting current limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for tripping. The load shall be automatically transferred to the bypass line uninterrupted for an internal UPS malfunction. Open protective devices shall be indicated by Light Emitting Diodes (LEDS) on the control panel.

### 2.7 DISPLAY AND CONTROLS

- A. The term UPS Module Control Panel, as used herein, denotes that portion of the UPS module containing the display screen and control functions. The display panel shall be liquid crystal type to provide complete monitoring and control using menu-prompted commands. Switches shall be used to select and execute operations from a Master Menu. The display and control panel shall be mounted on the control section door.
- B. UPS module system logic and control programming shall be resident in Application Specific Integrated Circuits. Logic components shall be physically isolated from heat sources and voltage hazards. There shall be two power supplies for the logic and control circuits, one connected to the input AC source and the other connected to UPS module output.
- C. Monitoring: UPS module monitoring shall be provided by a microprocessor-based graphic display capable of simultaneously reporting input and output and battery voltage and current; output frequency and total load KVA and KW for all three phases, within 1% accuracy.
  - 1. History File: The control system shall maintain this information in discrete windows updating memory on a First-In First-Out basis. This shall provide status recall of a period of at least 256 milliseconds (64 windows); 160 milliseconds before the malfunction (40 windows), and 96 milliseconds after the malfunction (24 windows).



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2. Power Flow Indication: Power flow indicators shall graphically depict whether the load is being supplied from UPS, bypass or battery and provide, on the same screen, input, output and battery voltage, amperages, frequency, KVA and KW. The following components must be indicated:
    - a. AC Input Circuit Breaker
    - b. Battery Circuit Breaker
    - c. Inverter Output Circuit Breaker
    - d. Bypass Switch
    - e. Static Transfer Switch (Off-Line/Available)
  3. Battery Status Indicator: The battery status indicator shall display DC alarm and shutdown voltages and maintain the battery voltage drop during discharge. Battery time remaining after a power outage shall be graphically displayed to permit prediction of battery shutdown.
- D. Alarms: The control panel shall report the system level alarms listed below. An audible alarm is to be activated when any of the above alarms occur. All alarms shall be displayed in text form.
1. Input Power Fail
  2. Output Overload
  3. Overload Shutdown
  4. Overload Transfer
  5. Emergency Power Off
  6. DC Over Voltage
  7. DC Cap Fuse
  8. Ambient Over-temp
  9. UPS Over-temp
  10. Over-temp Shutdown
  11. Low Battery Reserve
  12. Battery Disconnected
  13. Battery Discharging
  14. Rectifier Fuse Failure
  15. Inverter Fuse Failure
  16. Fan Failure

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17. Static Switch Disabled
  18. Bypass Not Available
  19. Auto Transfer to Bypass
  20. Reverse Power
  21. Control Power Failure
  22. Load on Bypass
  23. Output Over/Under Voltage
- E. Controls: System level control functions shall be:
1. UPS/Bypass Transfer Pushbuttons.
  2. AC Output Voltage Adjust 5%.
  3. Battery Circuit Breaker Trip Pushbutton.
  4. Emergency Power Off Pushbutton with Protective Cover.
  5. Alarm Silence Pushbutton.
  6. Control Enable Pushbutton.
  7. Display Control Switches.
  8. Alarm Reset Switch.
- F. Manual Procedures: Start-up, load transfers, and shutdown procedures shall be detailed on the display panel in text and graphic form.
1. Start-Up:
    - a. Step-by-step procedure screen.
    - b. Walk-in display screen to simultaneously indicated DC volts, output volts, and input phase amps.
    - c. Mimic screen to indicate power flow.
  2. Load Transfers:
    - a. Step-by-step procedure screen.
    - b. Mimic screen to indicate power flow.
  3. Shutdown:
    - a. Step-by-step procedure screen.

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- b. Mimic screen to indicate power flow.
- G. Emergency Power Off:
- 1. The UPS control panel shall have a local emergency shutdown. Pressing the emergency shutdown shall cause:
    - a. Uninterrupted transfer of the load to bypass.
    - b. The input, output, and battery breakers.
    - c. Power off circuit, which completely removes power from the critical bus when activated.
- H. Self-Diagnostics: The UPS module shall be provided with the following built-in diagnostics for troubleshooting and circuit alignment aids:
- 1. Rectifier in control mode.
  - 2. UPS synchronizing with critical load bus.
  - 3. Positive DC bus ground fault.
  - 4. Negative DC bus ground fault.
  - 5. Bypass frequency higher than system output frequency.
  - 6. Bypass frequency lower than system output frequency.
  - 7. Automatic static transfer lockout.
  - 8. Command given to close inverter output circuit breaker.
  - 9. Command given to close bypass switch.
  - 10. Command given to open inverter output circuit breaker/bypass switch.
  - 11. Degree of overload.
  - 12. Under-voltage trip for battery disconnect switch.
  - 13. Under-voltage trip for input circuit breaker.
- I. Remote Monitoring Capability: UPS control circuits shall be interfaced with the site central monitoring system (CMS). Interface shall be built into the UPS. The site monitoring signal processing module shall be factory installed. The following shall be available for display:
- 1. Metering:
    - a. Bypass volts (line-line, all phases)
    - b. Critical bus volts (line-line & line-neutral, all phases)
    - c. Critical bus current (all phases)

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- d. Critical bus frequency
  - e. Critical bus KVA
  - f. Critical bus KW
  - g. DC volts
  - h. Battery amps ( $\pm$ )
  - i. % Capacity
2. Digital Alarms:
- a. Fuse Cleared
  - b. Output Overload
  - c. Emergency Power Off
  - d. Ambient Over-temp
  - e. Battery Discharging
  - f. Low Battery Reserve
  - g. Load On Bypass
  - h. Static Switch Disabled
  - i. Battery Disconnected
  - j. Module Cooling Failure (Fan Failure or Over-temp)
  - k. Control Power Failure
3. Alarm Outputs: The following will have a N.O. isolated contact for remote indication on the RTU provided by others. Electrical Contractor shall route conduit and wire, make all connections.
- a. UPS System Mode
  - b. Battery Discharging
  - c. Low Battery Reserve
  - d. UPS Alarm Condition
- J. Communication Port: The UPS shall be provided with an RS-232 port capable of interfacing with a remote location. All monitoring information shall be capable of being downloaded to remote device.

### 2.8 STATIC TRANSFER SWITCH

- A. The term static transfer switch shall denote the solid-state device that automatically transfers the critical load to bypass without interruption if the UPS cannot supply continuous power. The term

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bypass switch shall denote the electromechanical device that will connect the load to bypass. Automatic load transfers are to be initiated when a malfunction occurs within the UPS or a sustained system overload occurs.

- B. Momentary Overloads: In the event of a branch load circuit fault or load current inrush, the static transfer switch is to pulse-on for at least 40 milliseconds allowing at least 1000% load current to flow from bypass line to clear the overload. If the overload is cleared, a load transfer shall not be made. If the overload is not cleared, then the transfer is to be accomplished maintaining load voltage within specified limits.
- C. Automatic Closing: The static transfer switch is to be of the energy saving type. Once the load is transferred to the bypass line by the static transfer switch, the bypass switch is to automatically close removing the static transfer switch from the power flow.
- D. Manual Transfers: A manual load transfer between the UPS and bypass line is to be initiated from the control panel. All transfers from bypass to the inverter shall be manually initiated.
- E. Switch Isolation: The static switch SCR device shall include series connected switch/circuit breaker and backfeed circuit monitoring per UL Standard 1778 for automatic (and manually) initiated circuit isolation of static switch SCR device.

**2.9 BATTERY DISCONNECT BREAKER**

- A. The UPS shall have a properly rated circuit breaker (500 VDC) to isolate it from the battery.
- B. The UPS shall automatically be disconnected from the battery by opening the switch when the battery reaches the minimum discharge voltage level or when signaled by other control functions.
- C. The UPS shall be provided with a pushbutton to trip the breaker from the control panel.

**2.10 BATTERY**

- A. Storage Battery: Valve regulated (sealed, reduced maintenance) type. Maximum specific gravity of 1.3, and minimum cell end voltage of 1.65 volts. Heavy duty industrial design. Provide with impact resistant plastic case which meets or exceeds 94V2 to meet UL Standard 1778 requirements.
- B. Batteries shall be furnished with flame arrestors, lead covered solid copper terminal posts, and transparent container to allow visual inspection of the plates and sediment spaces.
- C. Battery system shall be furnished as a part of the UPS system and sized to maintain the rated UPS system load output for the specified duration. Submit battery Amp-hour rating, cell end voltage, specific gravity, and battery system calculations with shop drawing submittals.
- D. Battery system design life shall be 10 years under full float operation and shall be provided with a pro rata cycle duty warranty based on the following discharges at the 15-minute rate:

NUMBER OF CYCLES	CYCLE DURATION			
	0 to 30s	30s to 1M	1M to 5M	5M to 15M
3,700	1,125	410	225	
2,700	600	200	120	
10,500	2,100	660	300	

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	4,571	2,560	853	481
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- E. The battery system shall provide 100% of specified capacity at initial start-up.
- F. Rack system shall be painted with corrosion resistant paint, and supplied with all required lead plated copper bolted connectors, terminal lugs, cable supports, rack mounting bolts, and accessories. Provide acid resistant aisle matting adjacent to racks.
- G. Racks shall be sized to fit into battery room as shown on the drawings and configured to hold batteries totaling 250 VDC maximum. Contractor shall size conductors and conduit between UPS and battery disconnect breaker, and between battery disconnect breaker and battery racks as required by UPS supplier. All cables leaving a continuous rack area shall be in conduit.
- H. Provide the following battery system accessories:
  - 1. Set of battery identification numbers.
  - 2. Battery arrangement and wiring diagram indicating battery numbers.
  - 3. Lifting strap and spreader block.
  - 4. Anti-corrosion compound.

### 2.11 EMERGENCY POWER OFF

- A. The UPS shall include an Emergency Power Off (EPO) circuit. Activating this circuit shall cause immediate shutdown of all UPS operations. This operation will shut down the critical load.
- B. The UPS module shall include provisions to activate the EPO circuit remotely by a contact closure.

### 2.12 ON-LINE UPS BATTERY MONITORING SYSTEM

- A. Manufacturers:
  - 1. Albercorp; Hawker Siddeley.
  - 2. BTECH Inc.
  - 3. MetriXX USA Inc.
  - 4. Powerware
- B. System Performance Characteristics:
  - 1. The System shall display, record the battery bank voltage and monitor, discharge current, cell voltages, temperature, cell resistance, intercell connection resistance, and interior resistances. The parameters above shall be continuously monitored using real time during normal operating times and during all battery discharges, the exception is during a resistance test programmed by the user.
  - 2. The system shall transfer all the battery parameters mention in the paragraph above to a remote computer. The intervals for this transfer shall be defined by the user.

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3. The system shall display, record and provide printouts for the following alarm conditions during the alarm. This should be displayed at the remote computer. The report shall include the following:
  - a. Individual cell voltage high and low alarm.
  - b. Individual internal resistance high alarm.
  - c. Individual internal resistance warning as a percentage of alarm threshold.
  - d. Intertier resistance high alarm
  - e. Overall voltage high and low alarm.
  - f. Temperature high and low.
  - g. Individual cell voltage low alarm during discharge.
  - h. Discharge.
  - i. Discharge time alarm set in hours and minutes.
  - j. Float current high alarms.
4. The system shall be capable of displaying the following reports:
  - a. Alarm condition reporting - tabular, fax or pager.
  - b. Cell/jar out-of-limits summary report - tabular.
  - c. Individual cell voltages over time - graph or tabular.
  - d. Individual cell resistance values over time - graph or tabular.
  - e. Total battery voltage over time - graph or tabular.
  - f. Battery temperature / room temperature over time - graph or tabular.
  - g. Discharge report: total battery voltage decay vs. time - graph or tabular.
  - h. Discharge hit summary report - tabular.
  - i. Discharge hit interval summary report - tabular.
  - j. General summary report of battery and monitor status of all systems to the battery or string level based on user set thresholds.
  - k. Detail summary reports of battery and monitor status of all systems with a line graph trend of any parameter that violated a threshold.
5. Every alarm record shall include the following:
  - a. Defined limits.

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- b. Alarming parameter.
  - c. Time and Date of event.
  - d. Peak value during alarm.
6. The system shall automatically page or fax a report to the user defined designated person or persons when an alarm function is noted.
  7. The system shall maintain and provide the following; real-time discharge event log and a dynamic on-line display of battery voltage, individual cell voltages, battery string current and ambient temperature whenever the battery is in a discharge mode. In addition to numerical display a graphical display of the battery and cell voltages versus time that allows a playback of the event.
    - a. Store data of the internal cell resistance of each cell.
    - b. Store data of each inter-cell connector resistance.
    - c. Display a snapshot of data of all battery parameters at the remote computer. Also display individual graphs of the battery parameters relative to the alarm.
  8. The system shall be password protected.
  9. The system shall be capable of measuring the following:
    - a. Individual cell voltage.
    - b. Individual cell DC resistance accomplished by applying a momentary load at user defined intervals.
    - c. Individual inter-cell resistance measurements performed at user defined intervals.
    - d. Individual interior resistance measurements performed at user defined intervals.
    - e. Total battery voltage per string.
    - f. Ambient or pilot cell temperature, with ability to add up to ten temperatures per string for temperature trending.
    - g. System discharge logging of the overall voltage, individual cells, discharge current, and temperatures.
    - h. Float current per string.
- C. Hardware Requirements:
1. System components shall be rack mountable.
  2. LEDs indicating status.
  3. Two RS-232 serial ports: One port shall be configured to be connected to a local PC at all times or a laptop for temporary viewing. The second port shall be configured to a network using TCP/IP.



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4. EEPROM: Nonvolatile memory for storage up to one year of data.
5. Factory supplied wiring harness to be installed in the field.
6. Individual fuses for each lead to cell/jar for resistance load test cables.
7. Individual fuses for each resistor terminated leads for voltage sensors.
8. Two dry contacts for annunciating alarm to reporting system, each contact shall be programmed for either critical or maintenance events.
9. Communication I/O devices as follows.
  - a. RS-232
  - b. Ethernet
  - c. Telephone via modem
  - d. Modbus protocol for third party interface

### D. Software Requirements:

1. Software shall operate on current Windows operating systems. The software shall maintain a data base of all information gained from the monitors for future analysis. The software shall be configurable from either a central, local or service computer. The central configuration will be responsible for removing any data that resides in the monitor E2 memory. The local configuration will not remove data from the E2 memory and will allow it to be removed from the central computer. The service configurations will allow technicians to call for real time data from remote locations. The software shall poll multiple monitoring systems on a programmed scheduled.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install UPS as shown on the drawings, and in accordance with manufacturer's instructions.
- B. Racks and equipment shall be installed level and in line with walls and room.
- C. The system provider shall provide a factory technician to supervise the system installation.

### **3.2 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing under provisions of Section 260500.
- B. Field Tests: Test static transfer from inverter to bypass and back. Test DC undervoltage trip level on inverter input breaker, test alarm circuits. Verify specification performance criteria; measure battery discharge and recharge times, measure and record battery float voltage and charging current, perform a battery capacity test, and measure and record all bolted battery connection resistances, and visually inspect all electrolyte levels and measure specific gravity of all cells; simulate fault in each system component and utility power; operate unit at 77°F for eight hours; at rated load using resistive bank; and other tests as recommended by manufacturer.

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### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Provide manufacturer's field services under provisions of Section 260500.
- B. Include services of technician to supervise adjustments, final connections, and system testing.
- C. The system provider's factory technician shall start up the system and perform all require acceptance tests to demonstrate the system is functional. A signed service report shall then be submitted after equipment is operational to initiate the warranty.

### 3.4 SERVICE PLAN

- A. Manufacturer shall provide a service plan to provide 7x24 on-site coverage (preventative and corrective) for UPS and batteries, guaranteed response time, remote monitoring, Web access to service site history, annual Site Audit, UPS and battery preventative maintenance visit, and discounts for upgrade and modification kits.
- B. Manufacturer shall also provide a battery service plan to provide parts-and-labor coverage for partial and full battery strings, either with preventative maintenance or replacement coverage.

**END OF SECTION 26 3353**

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**SECTION 26 3600  
TRANSFER SWITCH**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Automatic transfer switch with delayed transition and bypass/isolation switch ATS-#
- B. Portable generator and load bank connection cabinet (GCC-#)
- C. Remote annunciator for ATS RA-ATS-#

**1.2 RELATED SECTIONS AND WORK**

- A. Refer to the Transfer Switch Schedule for rating and configuration.

**1.3 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

**1.4 REFERENCES**

- A. NEMA ICS 1 - General Standards for Industrial Control and Systems
- B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
- C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
- D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment
- E. UL 1008 - Standard for Automatic Transfer Switches
- F. NFPA 99 - Health Care Code
- G. NFPA 110 - Standard for Emergency and Standby Power Systems

**1.5 SUBMITTALS**

- A. Submit shop drawings and product data under provisions of Section 26 0500.
- B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.
- C. Submit manufacturer's installation instructions under provisions of Section 26 0500.

**1.6 OPERATION AND MAINTENANCE DATA**

- A. Submit operation and maintenance data under provisions of Section 26 0500.
- B. Include instructions for operating equipment.

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- C. Include instructions for operating equipment under emergency conditions when engine generator is running.
- D. Identify operating limits which may result in hazardous or unsafe conditions.
- E. Document ratings of equipment and each major component.
- F. Include routine preventive maintenance and lubrication schedule.
- G. List special tools, maintenance materials, and replacement parts.

### 1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for emergency and standby electrical systems.

## PART 2 - PRODUCTS

### 2.1 AUTOMATIC TRANSFER WITH DELAYED TRANSITION AND BYPASS/ISOLATION SWITCH

- A. Automatic transfer switch, microprocessor controlled, three-position switch mechanism with bypass isolation, delayed transition and load shed capable, with local manual operation.
- B. Acceptable Manufacturers:
  - 1. Schneider Electric ASCO 7ATB Series
  - 2. Siemens Russelectric RTB Series
  - 3. ABB Zenith ZBTS / ZBTE Series
  - 4. Caterpillar CBTS Series
  - 5. Cummins BPTC Series
- C. Description: NEMA ICS 2; automatic transfer switch with center position delayed transition / off and manual bypass switch.
- D. Configuration: Draw-out type electrically-operated, mechanically-held transfer switch with manually-operated CONNECTED, TEST, and DISCONNECTED draw-out positions, and with mechanically-operated, mechanically-held transfer switch connected to bypass automatic switch.
- E. Bypass Switch Ratings: Match automatic transfer switch for electrical ratings.

### 2.2 PORTABLE GENERATOR / LOAD BANK CONNECTION CABINET (GCC-

- A. Acceptable Manufacturers:
  - 1. Foxfab FFCC Series
  - 2. Berthold Electric Co
  - 3. Power Temp Systems Inc

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4. ESL Power Systems Triple Switch Series
  5. Trystar
- B. Pad mount, powder coat painted NEMA 3R housing with lockable door, 1200amps, 600 volt. Color-coded cam-lock connectors. Submit product data and dimensioned drawings. Color selection by Architect.
1. Load Bank Cam Lock Receptacle: Female or male cable
  2. Portable Generator Cam Lock Receptacle: Male or female cable
  3. Cam Lock Configuration: Power flow from female to male; note ground / neutral configurations are opposite of phase conductors at the same connection location.
- C. Three-way Manual Transfer Switch: Provide-three-way switch to allow flexible connection between; onsite generator and load bank, portable generator and load, onsite generator and load.
- D. Generator Start Signals: Provide parallel generator start cabling from the transfer switches to the portable generator cabinet. Provide quick connect type connections for the generator start signals.

### 2.3 SERVICE CONDITIONS

- A. Service Conditions: NEMA ICS 1. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

### 2.4 RATINGS

- A. Refer to the electrical diagrams for the Withstand and Close Ratings WCR available interrupting capacity (AIC) at the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two Short Circuit Current Ratings SCCR values when the SCCR rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal.
- B. Series rating with upstream devices shall be allowed per UL-1008.

### 2.5 AUTOMATIC SEQUENCE OF OPERATION

- A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
- B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.
- C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
- D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
- E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
- F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

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G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

### 2.6 ENCLOSURE

A. Enclosure: NEMA ICS 6; Type 1.

### 2.7 ACCESSORIES

A. Load Shed:

1. The controller shall be capable of being programmed to automatically shed the connected load from the generator in the event of a user configurable under- frequency, under-voltage or overload condition. Under-frequency shedding shall occur if generator is less than 58Hz for greater than 3 seconds or less than 50 Hz for greater than 0.5 seconds.
2. Switch shall be configurable to pick up an output status relay upon activation of the auto load shed feature. Output shall be usable to trip/isolate downstream loads in the event of an overload.
3. Reset of the auto load shed function shall be via operator reset on display, remote reset contact input, or via network signal.

B. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

C. Test Switch: Key operated or password protected switch. Mount in cover of enclosure to simulate failure of normal source.

D. Engine Start Signal: Rated 10 amps at 30VDC shall be provided to start the engine generator in the event of a normal source outage.

E. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.

F. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

G. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed indicating switch to normal source or emergency source.

H. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, values shall be field adjustable.

I. Alternate Source Monitor: Monitor each line of alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent Hertz from rated nominal voltage, values shall be field adjustable.

J. Engine Exerciser: Start engine every 7 14 28 days. Run for 30 minutes before shutting down. Each event shall be configurable for Test with Load or Test Without Load. Bypass exerciser control if normal source fails during exercising period.

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- K. In-Phase Monitor: Inhibit transfer until source and load are within 30 electrical degrees.
- L. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:
  - 1. Normal source available.
  - 2. Emergency source available.
  - 3. Exercise mode in operation.
- M. Serial Communication Port: Two twisted pairs of shielded communication cable in conduit shall daisy chain all transfer switches with a remote annunciator.
- N. RA-ATS- Remote Annunciator: A remote annunciator shall be provided that shall monitor and control the following functions for each transfer switch:
  - 1. Load Connect to Emergency/Normal Indication
  - 2. Source Available: Emergency/Normal Indication
  - 3. Time Delay Indication and Key Locked Bypass Switch
  - 4. Transfer Test Indication and Key Locked Switch
  - 5. Remote transfer loads between normal and emergency sources with Key Locked Switch
  - 6. Remote generator start with Key Locked Switch
  - 7. Remote generator stop with Key Locked Switch
- O. Annunciators shall be located where shown on the drawings, as directed by the Owner. Extend conduit and wire as required by the manufacturer.
- P. An adjustable emergency to normal pre-signal signal to elevator controller.
- Q. Metering Capabilities: The following metered readings shall be available at the local display. The metering information shall also be shared by serial connection to the master control cubicle of the emergency power paralleling equipment.
  - 1. Current, per phase RMS and neutral
  - 2. Current unbalance %
  - 3. Voltage, phase-to-phase and phase-to-neutral
  - 4. Voltage unbalance %
  - 5. Real power (KW), per phase and 3-phase total
  - 6. Apparent power (KVA), per phase and 3-phase total
  - 7. Reactive power (KVAR), per phase and 3-phase total

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8. Power factor, 3-phase total & per phase
9. Frequency
10. Accumulated energy, (KWH, KVAH, and KVARH)
11. Demand, (KWH, KVA)

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as instructed by the manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means acceptance of existing conditions.

#### **3.2 CONTROL AND SIGNAL CABLING**

- A. Provide control and signal cabling per manufacturer recommendations for the following systems components:
  1. Remote annunciator.
  2. Elevator controller. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.
  3. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:
    - a. Fire pump transfer switch
    - b. Emergency, legally required, optional standby transfer switches
    - c. Approved Methods:
      - 1) Raceway or cable encased in a minimum of 2 inches of concrete cover.
      - 2) Listed fire resistive raceway / cable system.
      - 3) Raceway / cable is protected by a listed electrical circuit protective system.

#### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

**END OF SECTION 26 3600**

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**SECTION 26 4300  
SURGE PROTECTION DEVICES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, electronic equipment, elevators, and receptacle devices.

**1.2 QUALITY ASSURANCE**

- A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.
- B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

**1.3 REFERENCES**

- A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components
- B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components
- C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices
- F. CBEMA - Computer Business Equipment Manufacturers Association
- G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage
- H. NFPA 70 - National Electrical Code (NEC)
- I. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors
- J. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)
- K. UL 248-1 - Fusing
- L. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

**1.4 SUBMITTALS**

- A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current

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rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.

- B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

### 1.5 SPARE PARTS

- A. Surge Protection Modules: Furnish 1 replacement module for each type installed.
- B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

### 1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

- A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.
  - 1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
  - 2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50 $\mu$ s, 6000V open circuit voltage waveform and an 8 x 20 $\mu$ s, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
  - 3. A single 8 x 20 $\mu$ s waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.
- B. Minimum Repetitive Surge Current Capacity:
  - 1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
  - 2. Minimum Repetitive Surge Current Capacity Test:
    - a. An initial UL 1449 surge defined as 1.2 x 50 $\mu$ s, 6000V open circuit voltage waveform and an 8 x 20 $\mu$ s, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
    - b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50 $\mu$ s 10kV or 20kV open circuit voltage waveform and an 8 x 20 $\mu$ s 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
    - c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.

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3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
  4. Proof of such testing shall be the test log generated by the surge generator.
- C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.
- D. Warranty: Ten (10) years. Includes workmanship, installation and programming.
- E. No scheduled parts replacement or preventative maintenance shall be required.

### **PART 2 - PRODUCTS**

#### **2.1 DESCRIPTION**

- A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.
- B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

#### **2.2 RATINGS**

- A. SPD-; Service Entrance Suppressors:
1. For 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.
    - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase
    - b. Nominal Discharge Current: 20 kA.
    - c. Mounting: Refer to the drawings.
    - d. Voltage Protection Rating: Refer to requirements below.
    - e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
    - f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
  2. Manufacturers:
    - a. Square D SurgeLogic EMA Series
    - b. Siemens TPS3 Series
    - c. Eaton SPD Series
    - d. Current Technology Current Guard Plus
- B. SPD-; Service Entrance Suppressors - Hybrid:

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1. For 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.
    - a. Surge current capacity: 120,000/240,000 amps per protection mode/phase
    - b. Nominal Discharge Current (IN): 20 kA.
    - c. Mounting: Refer to the drawings.
    - d. Voltage Protection Rating: Refer to requirements below.
    - e. Components: Minimum component size of modular 20mm thermally protected metal oxide varistors (MOV). Modular hybrid combination of 20mm MOV may be combined with silicon avalanche diodes (SAD) or selenium cells.]
  2. Manufacturers:
    - a. Current Technology SL3 Series
    - b. ASCO Power Technologies 570 Series
    - c. LEA International DS Series
- C. SPD- Secondary Distribution Suppressors:
1. For 120/208-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.
    - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase
    - b. Nominal Discharge Current (IN): 20 kA.
    - c. Mounting: Refer to the drawings.
    - d. Voltage Protection Rating: Refer to requirements below.
    - e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).
  2. Manufacturers:
    - a. Square D Surgellogic EMA Series
    - b. Siemens TPS3 Series
    - c. Eaton SPD Series
    - d. Current Technology Current Guard Plus
- D. SPD-; Secondary Distribution Suppressors - Hybrid:
1. For 120/208-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.
    - a. Surge current capacity: 100,000/200,000 amps per protection mode/phase.
    - b. Nominal Discharge Current (IN): 20 kA.

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- c. Mounting: Refer to the drawings.
  - d. Voltage Protection Rating: Refer to requirements below.
  - e. Components: Minimum component size of modular 20mm thermally protected metal oxide varistors (MOV). Modular hybrid combination of 20mm MOV may be combined with silicon avalanche diodes (SAD) or selenium cells.
2. Manufacturers:
- a. Square D Surgelogic EMA Series
  - b. Siemens TPS3 Series
  - c. Eaton CPS Series
  - d. Current Technology SEL Series
- E. SPD-; Critical Load Protection - Fixed Equipment:
- 1. For 120-volt, 1 phase, 3 wire, type 3, category A3 unit.
    - a. Surge Current Capacity (IN): 15,000 amps per protection phase
    - b. Mounting: External, NEMA 1 enclosure
    - c. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
    - d. Protection Modes and UL 1449 Clamping Voltage: 700 volt L-N, L-G, and 900 volt N-G.
  - 2. Manufacturers:
    - a. Square D
    - b. Siemens
    - c. Eaton
    - d. Current Technologies
- F. SPD-; Critical Load Protections - Fixed Equipment - DIN Rail Mount:
- 1. For 120 120/208volt, 3 phase, type 2 unit. Refer to schedule or equipment requirements for specific equipment configuration required.
  - 2. For plug-in modules to mount on DIN rail in control panels, motor control centers, etc.:
    - a. Surge Current Capacity: 25,000/50,000 amps per protection mode/phase
    - b. Nominal Discharge Current (IN): 20 kA
    - c. Components: Metal oxide varistors (MOV)

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3. Manufacturers:
  - a. General Electric TD Series
  - b. Bussman BSP Series
  - c. ASCO Power Technologies 318 Series
  - d. Mersen Surge Trap Series
  - e. Or approved equal

### G. Receptacles:

1. For 120-volt, 1 phase, 3 wire, type 3, category A3 unit.
  - a. Surge current capacity (IN): 12,000 amps per protection mode.
  - b. Components: 20mm MOV
  - c. Maximum Continuous Operating Voltage: 150 Volts
2. Refer to Specification Section 262726 for additional receptacle construction information.

### H. Voltage Protection Rating:

1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).
  - a. 277/480 Volt, 3 phase, 4 wire. 1200 Volt L-N, L-G, N-G and 1800 Volt L-L
  - b. 480 Volt, 3 phase, 3 wire. 2000 Volt L-G, L-L
  - c. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L
  - d. 240 Volt, 3 phase, 3 wire. 1200 Volt L-G, L-L
  - e. 120/240 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L

### I. Indication:

1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
2. Each unit shall include an audible alarm with silencing switch to indicate when protection has failed.
3. Provide each service entrance secondary distribution and critical load type unit(s) with a transient counter.
4. Each unit shall contain form "C" contacts for remote indication of an alarm status.

### J. Fuses:

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1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.
- B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

#### **3.2 INSTALLATION**

##### **A. Mounting Location:**

1. The unit shall be installed as close as practical to the panel and transformer secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the transformer or switchboard or panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. Integral surge protection devices mount between the main and branch circuit breakers.
3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

##### **B. Connections:**

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard or be equipped with a factory supplied integral fused switch or circuit breaker. Single phase 120-volt units shall be hardwired without a disconnecting means.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

##### **C. Additional Locations: Critical Load Protection - Fixed Equipment (120 Vac):**

1. Install an A3 hard-wired surge protection device between each of the following equipment items and its power supply conductors.
  - a. Fire alarm master panel

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- b. Phone switch
- c. Intercom master
- d. Building management system master
- e. Security system master
- f. Telephone switch
- g. TV head
- h. Elevator control panel

**D. General:**

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.

**END OF SECTION 26 4300**



**SECTION 26 5119  
LED LIGHTING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Interior luminaires and accessories
- B. Exterior luminaires and accessories
- C. Light-emitting diode (LED) luminaire systems
- D. LED emergency lighting units
- E. Emergency exit signs
- F. Emergency inverter for LED light engines (individual luminaires - integral)

**1.2 RELATED SECTIONS**

- A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
  - 1. Section 26 0933 - Lighting Control Systems.
  - 2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

**1.3 REFERENCES**

- A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
- C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- D. NFPA 70E - National Electrical Safety Code
- E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
- F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
- G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

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- H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
- I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- J. UL 924 - Standard for Emergency Lighting and Power Equipment
- K. UL676 Standard for Underwater Luminaires and Submersible Junction Box
- L. Project site classification as defined in IESNA RP-33 LZ2.

### 1.4 SUBMITTALS

- A. Submit product data under provisions of Section 26 0500.
- B. Basic Requirements of Submittal:
  - 1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
  - 2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
  - 3. Include outline drawings, support points, weights, and accessory information for each luminaire.
  - 4. Submit manufacturer origin of LED chipset and driver.
- C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
  - 1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
  - 2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.
- D. LED Lighting - Control Compatibility Submittal:
  - 1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

### 1.5 EXTRA STOCK

- A. Provide extra stock under provisions of Section 26 0500.
- B. LED Light Engines or Modules: Three (3) percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.
- C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.
- D. LED Drivers: Three (3) percent of quantity installed, minimum one (1) of each size and type.

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- E. Exit Signs: Provide four (4) additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect under provisions of Section 26 0500.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.
- C. Handle site lighting poles carefully to prevent breakage and damage to finish.

### 1.7 MOCKUP

- A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

### 1.8 WARRANTY

- A. The warranty period begins at the date of Substantial Completion.
- B. LED Light Engines and Drivers:
  - 1. LED Drivers and Dimming Drivers: Five (5) years
  - 2. Light Emitting Diode (LED) Light Engines: Five (5) years
- C. Emergency Lighting Units and Exit Signs:
  - 1. Emergency Lighting Units: Three (3) year, non-prorated
  - 2. Exit Signs: Three (3) year, non-prorated
  - 3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.
- D. Emergency Drivers:
  - 1. Emergency LED Driver: Five (5) years
- E. Emergency Inverter for LED Light Engines:
  - 1. Emergency Inverter and Battery: Sealed nickel cadmium five (5) year, non-prorated.

### 1.9 REGULATORY REQUIREMENTS

- A. Conform to NFPA 101 for installation requirements

## PART 2 - PRODUCTS

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### 2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
- B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
- C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.
- D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
- E. Painted reflector surfaces shall have a minimum reflectance of 90%.
- F. All painted components shall be painted after fabrication.

### 2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
- B. Provide low temperature LED drivers, with reliable starting to -20°F.

### 2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Refer to the luminaire schedule for color temperature and minimum color rendering index CRI requirements. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.
- B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.
- C. Rated life shall be minimum of 50,000 hours at L70.
- D. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
- E. Luminaire delivered lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.
- F. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.
- G. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.
- H. LED Driver:
  - 1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 20%. Driver

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shall have a voltage fluctuation tolerance of +/- 10%.

2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
3. Driver shall have a minimum of 50,000 hours rated life.
4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
5. Driver shall be field replaceable without removal of the luminaire.
6. Class A sound rating; inaudible in a 27 dBA ambient.
7. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

### 2.4 LED EMERGENCY LIGHTING UNITS

- A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Battery: Maintenance free lead calcium type, with 90 minute capacity to supply the connected lamp load.
- C. Charger: Dual-rate solid state current limiting charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.
- D. LED Lamp Wattage: As scheduled on luminaire schedule.
- E. Remote Lamps: Match LED lamps on unit.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- G. Provide test switch to transfer unit from normal supply to battery supply.
- H. Electrical Connection: Knockout for conduit connection.
- I. Unit Voltage: Refer to luminaire schedule volts, AC.
- J. Self-Diagnostics and Testing:
  1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.

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2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

### 2.5 EMERGENCY EXIT SIGNS

- A. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.
- C. Self-Diagnostics and Testing:
  1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
  2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

### 2.6 EMERGENCY INVERTER FOR LED LIGHT ENGINES (INDIVIDUAL LUMINAIRES - INTEGRAL)

- A. Unit: Self-contained, with automatic transfer to battery supply on loss of normal power, UL 924 listed for factory or field installation, indoor and damp locations, 32°F to 122°F operating temperature. Compatible with switched, dimmed, and unswitched lighting controls. Compatible with LED light engines. The inverter output shall be sinusoidal with solid-state low voltage disconnect circuit.
- B. Battery: Sealed, high temperature, maintenance free, nickel cadmium battery with capacity to provide 90 minutes of emergency operation at full lumen and wattage output, with 24-hour recharge time. Refer to Luminaire Schedule for lumen and wattage requirements.
- C. Features: Integral battery charger with LED charging indicator light, test switch, electronic circuitry for use with LED drivers. Test and monitor switch shall be integral to luminaire or mounted flush in finished ceiling per Luminaire Schedule.
- D. Factory and Field Installation: Listed for installation inside and adjacent to luminaire. Refer to Luminaire Schedule for individual luminaire requirements. Remote-mounted units shall be located above finished ceiling, adjacent to luminaire, and accessible from below through luminaire opening.
- E. Self-Test Diagnostics and Testing: Provide with listed automatic monthly self-test diagnostics.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

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- A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.
  - 1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:
    - a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
    - b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
    - c. Luminaires larger than eight square feet (8 ft<sup>2</sup>): Support luminaire independent of the ceiling system.
- B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.
- C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
- D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
- E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (C<sub>c</sub>) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.
- F. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.
- G. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.
- H. Industrial Pendant Luminaires: Use hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.

### 3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

- A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.
- B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

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### 3.3 AUTOMATIC LOAD CONTROL RELAYS

- A. Factory or field installation per manufacturer requirements.
- B. Remote Test Switch: Provide connection to remote test switch.
- C. Fire Alarm Override: Provide connection to addressable fire alarm relay.

### 3.4 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

- A. Install units plumb and level.
- B. Aim directional lamp heads as directed.
- C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

### 3.5 RELAMPING

- A. Replace failed LED light engine modules or arrays at completion of work.

### 3.6 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

### 3.7 OWNER TRAINING

- A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.
- B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

### 3.8 LUMINAIRE SCHEDULE

- A. As shown on the drawings.

**END OF SECTION 26 5119**



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**SECTION 27 0500  
BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.
- B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

**1.2 SCOPE OF WORK**

- A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.
- B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.
- C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.
- D. Description of Systems include, but are not limited to, the following:
  - 1. Complete Structured Cabling System including, but not limited to:
    - a. Voice and data backbone cabling and terminations.
    - b. Voice and data horizontal cabling and terminations.
    - c. Information outlets (IOs) including faceplates, jacks and labeling.
    - d. Equipment racks, cabinets, cable management and equipment.
    - e. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
    - f. Cabling pathways.
    - g. Grounding and Bonding
    - h. Testing
  - 2. Mounting and patching of wireless access points provided by others.
  - 3. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
  - 4. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.

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5. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
6. Firestopping of penetrations as described in Division 7.
7. Seismic requirements as described in Section 26 0548 - Seismic Requirements for Equipment and Supports.

### 1.3 OWNER FURNISHED PRODUCTS

- A. [Insert]

### 1.4 WORK SEQUENCE

- A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.
- B. Itemize all work and list associated hours and pay scale for each item.

### 1.5 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

- A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.
- B. Definitions:
  1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
  2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
  3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
  4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.
  5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall

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be routed to the bottom of the exposed structural joists.

### C. General:

1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, cable tray, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
  - a. Lighting Fixtures
  - b. Gravity Flow Piping, including Steam and Condensate
  - c. Sheet Metal
  - d. Electrical Busduct
  - e. Cable Trays, including 12" access space
  - f. Sprinkler Piping and other Piping
  - g. Conduit and Wireway
  - h. Open Cabling

### D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.

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2. Assumes all responsibility for providing and installing cable tray.
  3. Responsible for Communications Systems grounding and bonding.
  4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.
- E. Technology Contractor's Responsibility:
1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
  2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
  3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
  4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
  5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

### 1.6 COORDINATION DRAWINGS

- A. Definitions:
1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
    - a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    - b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    - c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    - d. Maintenance clearances and code-required dedicated space shall be included.

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- e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
  2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
    - a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
  3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.
- B. Participation:
1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
  2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Electrical Contractor.
    - a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
  3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.
- C. Drawing Requirements:
1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
    - a. Scale of drawings:
      - 1) General plans: 1/4 Inch = 1'-0" (minimum).
      - 2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
      - 3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).

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- 4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
- 5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).
2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

### D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
  - a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

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- b. Potential layout changes shall be made to avoid additional access panels.
  - c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
  - d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
  - e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

### 1.7 QUALITY ASSURANCE

#### A. Telecommunications Structured Cabling System Standards:

- 1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:
  - a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
  - b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises
    - 1) C.1 - Commercial Building Telecommunications Standard
    - 2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
    - 3) C.3 - Optical Fiber Cabling Components Standard
    - 4) C.4 - Broadband Coaxial Cabling and Components Standard
  - c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
  - d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
  - e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
  - f. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
  - g. ANSI/TIA-862-A - Building Automation Systems Cabling Standard

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- h. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- i. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
- j. NFPA 70 (NEC) - National Electrical Code (Current Edition)
- k. UL 444 - Standard for Safety for Communications Cable

### B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. [Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project.] Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.
7. The Contractor shall have certified BICSI installation technicians or CNet CNIT (Certified Network Infrastructure Technician) on staff to perform the following tasks on the project:
  - a. Act as the field superintendent or job foreman with the responsibility of monitoring the daily work of each technician.
  - b. Oversee all testing and termination of cabling.
8. The Contractor shall have certified BICSI Installer 2 or CNet CNCI (Certified Network Cabling Installer) on staff to perform the following tasks:
  - a. Installation and termination of copper cable.
  - b. Installation and termination of optical fiber.
9. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

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- a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
  - b. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.
  - c. Resume and certification of the RCDD or CNIDP for the project as required by the form at the end of this specification section.
  - d. Resume and certification of the BICSI installation technician or CNet CNIT for the project.
- C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City of Sparks Codes, Laws, Ordinances and other regulations having jurisdiction.
  2. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
  3. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
  4. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
  5. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
- D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
  2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
  3. Pay all applicable charges for such permits or licenses that may be required.
  4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
  5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
  6. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):

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a. Underwriters' Laboratories, Inc.

### E. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

### F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

### G. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

## 1.8 SUBMITTALS

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- A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

Referenced Specification Section	Submittal Item	Coordination Drawings
27 05 03	Through Penetration Firestopping	
27 05 26	Communications Bonding	
27 05 28	Interior Communications Pathways	Yes
27 05 43	Exterior Communications Pathways	Yes
27 05 53	Identification and Administration	Yes
27 11 00	Communication Equipment Rooms	Yes
27 13 00	Backbone Cabling Requirements	Yes
27 13 43.53	Television Distribution System	
27 15 00	Horizontal Cabling Requirements	Yes
27 17 10	Testing	Yes
27 41 00	Professional Audio Video System	
27 51 13	Paging Systems	
27 51 19	Sound Masking System	
27 51 23.50	Integrated Communication System	
27 52 23	Nurse Call	
27 52 23.01	Wireless Nurse Call	
27 53 13	Central Clock System	
27 53 13.13	Wireless Clock System	
27 52 23.01	Wireless Nurse Call	
27 53 19	Distributed Antenna System (DAS)	

**1.9 GENERAL SUBMITTAL PROCEDURES: IN ADDITION TO THE PROVISIONS OF DIVISION 1, THE FOLLOWING ARE REQUIRED:**

- A. Transmittal: Each transmittal shall include the following:
1. Date
  2. Project title and number
  3. Contractor's name and address
  4. Description of items submitted and relevant specification number
  5. Notations of deviations from the contract documents
  6. Other pertinent data
  7. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
    - a. Date

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- b. Project title and number
  - c. Architect/Engineer
  - d. Contractor and subcontractors' names and addresses
  - e. Supplier and manufacturer's names and addresses
  - f. Description of item submitted (using project nomenclature) and relevant specification number
  - g. Notations of deviations from the contract documents
  - h. Other pertinent data
  - i. Provide space for Contractor's review stamps
8. Composition:
- a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
  - b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
  - c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
9. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
10. Contractor's Approval Stamp:
- a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
  - b. Unstamped submittals will be rejected.
  - c. The Contractor shall provide proof of RCDD or CNIDP review on the submittal.
  - d. The Contractor's review shall include, but not be limited to, verification of the following:
    - 1) Only approved manufacturers are used.
    - 2) Addenda items have been incorporated.

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- 3) Catalog numbers and options match those specified.
  - 4) Performance data matches that specified.
  - 5) Electrical characteristics and loads match those specified.
  - 6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
  - 7) Dimensions and service clearances are suitable for the intended location.
  - 8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
  - 9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
- e. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
  - f. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
11. Submittal Identification and Markings:
- a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
  - b. The Contractor shall clearly indicate the size, finish, material, etc.
  - c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
  - d. All marks and identifications on the submittals shall be unambiguous.
12. Schedule submittals to expedite the project. Coordinate submission of related items.
13. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
14. Reproduction of contract documents alone is not acceptable for submittals.
15. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
16. Submittals not required by the contract documents may be returned without review.

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17. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
18. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
19. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
20. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
  - a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.
21. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

### B. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. Submittal file name: 27 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.10 SCHEDULE OF VALUES

- A. The requirements herein are in addition to the provisions of Division 1.
- B. Format:
  1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.

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2. Submit in Excel format.
  3. Support values given with substantiating data.
- C. Preparation:
1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
  2. Break down all costs into:
    - a. Material: Delivered cost of product with taxes paid.
    - b. Labor: Labor cost, excluding overhead and profit.
  3. Itemize the cost for each of the following:
    - a. Overhead and profit.
    - b. Bonds.
    - c. Insurance.
    - d. General Requirements: Itemize all requirements.
  4. For each line item having an installed cost of more than \$5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:
    - a. Structured cabling
    - b. Overhead paging/intercom systems
    - c. Security systems
      - 1) Surveillance
      - 2) Access control
    - d. Audio/video systems
- D. Update Schedule of Values when:
1. Indicated by Architect/Engineer.
  2. Change of Subcontractor or supplier occurs.
  3. Change of product or equipment occurs.

### 1.11 CHANGE ORDERS

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- A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.
- B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.
- C. Change order work shall not proceed until authorized.

### 1.12 EQUIPMENT SUPPLIERS' INSPECTION

- A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:
  - 1. Firestopping, including mechanical firestop systems.

### 1.13 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

- A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.
- B. Store materials on the site to prevent damage.
- C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

### 1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

- A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

### 1.15 WARRANTY

- A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.
- B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.
- C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal

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wear as determined by the Architect/Engineer.

### 1.16 INSURANCE

- A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

### 1.17 MATERIAL SUBSTITUTION

- A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.
- B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.
- C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.
- D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

## PART 2 - PRODUCTS

### 2.1 CABLE JACKET RATING

- A. This project requires all cable jackets to carry a plenum rating.

### 2.2 REFER TO INDIVIDUAL SECTIONS.

## PART 3 - EXECUTION

### 3.1 JOBSITE SAFETY

- A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction

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means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Installation of all conduit and cabling shall comply with Sections 26 0533 and 26 0513. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 260533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.
- B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.
- C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.
- D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

### 3.3 FIELD QUALITY CONTROL

- A. General:
  - 1. Refer to specific Division 27 sections for further requirements.
  - 2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
  - 3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
  - 4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

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5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.
- B. Protection of cable from foreign materials:
1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
  2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

### 3.4 PROJECT CLOSEOUT

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Final Jobsite Observation:
1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
  2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
  3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.
- C. Before final payment will be authorized, this Contractor must have completed the following:
1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
  2. Record documents including edited drawings and specifications accurately reflecting field conditions, inclusive of all project revisions, change orders, and modifications.
  3. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent

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of This Contractor and shall be signed by the Owner's representative as having received the instructions.

4. Submitted testing reports for all systems requiring final testing as described herein.
5. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to [ project site] [insert address here]; submit receipt to Architect/Engineer prior to final payment being approved.
7. Provide System Assurance Warranty certificate for the telecommunications system.

### 3.5 OPERATION AND MAINTENANCE MANUALS

#### A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

#### B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
  - a. O&M file name: O&M.div27.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. All text shall be searchable.
7. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

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- C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
  2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
  3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
  4. Copy of final approved test and balance reports.
  5. Copies of all factory inspections and/or equipment startup reports.
  6. Copies of warranties.
  7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
  8. Dimensional drawings of equipment.
  9. Capacities and utility consumption of equipment.
  10. Detailed parts lists with lists of suppliers.
  11. Operating procedures for each system.
  12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
  13. Repair procedures for major components.
  14. List of lubricants in all equipment and recommended frequency of lubrication.
  15. Instruction books, cards, and manuals furnished with the equipment.

### 3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

- A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.
- B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.
- C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

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- D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.
- E. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.
- F. Refer to the individual specification sections for minimum hours of instruction time for each system.
- G. Operating Instructions:
  - 1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
  - 2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

### 3.7 SYSTEM STARTING AND ADJUSTING

- A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.
- B. All operating conditions and control sequences shall be simulated and tested during the start-up period.
- C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

### 3.8 RECORD DOCUMENTS

- A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.
- C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the

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location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

- D. Record actual routing of all conduits sized 2" or larger.
- E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.
- F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

### 3.9 ADJUST AND CLEAN

- A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.
- B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.
- C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

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**STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION**

D. To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 75% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 25% of testing has been completed.
6. Telecommunications labeling has been provided on at least 25% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
8. All Audio/Visual components, cabling and control systems are installed, programmed and operational.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All CCTV cameras, mounts, cabling and all headend equipment are installed, programmed and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: \_\_\_\_\_ By: \_\_\_\_\_

Requested Observation Date \_\_\_\_\_ Today's Date: \_\_\_\_\_

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.



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**TELECOMMUNICATIONS - PROOF OF CERTIFICATION**

There are specific Contractor qualification requirements for this project as defined in Section 270500, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 0500.

Statement of Compliance:

The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer [Insert]. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: \_\_\_\_\_

Authorized Representative: (print) \_\_\_\_\_

Date: \_\_\_\_\_

Manufacturer Certification Number (if any): \_\_\_\_\_

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: \_\_\_\_\_

RCDD #: \_\_\_\_\_ Expiration: \_\_\_\_\_

Submit the following with the bid:

This form.

Proof of Manufacturer Certification indicated above.

Proof of RCDD or CNIDP status.

**END OF SECTION 27 0500**

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**SECTION 27 0503  
THROUGH PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Through-Penetration Firestopping.

**1.2 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.

**1.3 REFERENCES**

- A. UL 263 - Fire Tests of Building Construction and Materials
- B. UL 723 - Surface Burning Characteristics of Building Materials
- C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
- D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
- E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
- F. Intertek / Warnock Hersey - Directory of Listed Products
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops
- I. IBC 2018 - International Building Code
- J. NFPA 5000 – Building Construction Safety Code

**1.4 SUBMITTALS**

- A. Submit under provisions of Section 27 0500.
- B. Submit Firestopping Installers Certification for all installers on the project.
- C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

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3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.
- E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.
- F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
- B. Install material prior to expiration of product shelf life.

### 1.6 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
  2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
  1. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.
- C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E84.

### 1.7 MEETINGS

#### Through Penetration Firestopping - 27 0503

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- A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.
  - 1. Review foreseeable methods related to firestopping work.
  - 2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

### 1.8 WARRANTY

- A. Provide one year warranty on parts and labor.
- B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
  - 1. 3M; Fire Protection Products Division
  - 2. Hilti, Inc.
  - 3. Tremco; Sealant/Weatherproofing Division
  - 4. Specified Technologies Inc. (S.T.I.)

### 2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.
- B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.
- C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.
- D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.
- E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.
- F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

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G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

a. F Rating = Floor/Wall Rating

*Alternate method of firestopping is patching opening to match original rated construction.
*Alternate method of firestopping is patching opening to match original rated construction.

H. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

1. F Rating = Wall/Floor Rating

*Alternate method of firestopping is patching opening to match original rated construction.
---

I. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

J. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.
- B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.
- C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.
- D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

**3.2 INSTALLATION**

- A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

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- B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.
- C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### 3.3 CLEANING AND PROTECTING

- A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.4 IDENTIFICATION

- A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:
  - 1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

### 3.5 INSPECTION

- A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.
- B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.
- C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

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**SECTION 27 0526  
COMMUNICATIONS BONDING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Bonding Conductors
- B. Bonding Connectors
- C. Grounding Busbar (PBB and SBB)
- D. Rack-mount Telecommunications Grounding Busbar

**1.2 RELATED WORK**

- A. Section 26 0533 - Conduit and Boxes
- B. Section 26 0536 - Cable Trays
- C. Section 26 0513 - Wire and Cable
- D. Section 26 0526 - Grounding and Bonding
- E. Section 27 0500 - Basic Communications Systems Requirements
- F. Section 27 0503 - Through Penetration Firestopping
- G. Section 27 1100 - Communication Equipment Rooms
- H. Section 27 0528 - Interior Communication Pathways
- I. Section 27 0553 - Identification and Administration

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 270500 for relevant standards.

**1.4 REFERENCES**

- A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems
- B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
- D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- E. ANSI/TIA 758 - Customer Owned Outside Plant

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- F. ANSI-J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- I. NFPA 70 - National Electrical Code
- J. NFPA 780 - Standard for the Installation of Lightning Protection Systems
- K. UL 96 - Lightning Protection Components
- L. UL 96A - Installation Requirements for Lightning Protection Systems
- M. UL 467 - Grounding and Bonding Equipment

### 1.5 SUBMITTALS

- A. Submit product data and shop drawings under provisions of Section 27 0500 and Division 1.
- B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
  - 1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
  - 2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Provide system checkout test procedure to be performed at acceptance.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under the provisions of Section 27 0500.
- B. Store and protect products under the provisions of Section 27 0500.
- C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

### 1.7 SYSTEM DESCRIPTION

- A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.
- B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every

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equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.

- C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.
- D. Basic System Requirements:
  - 1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-D and NFPA 70 for complete information.
  - 2. The bonding system shall include, but not be limited to, the following major components:
    - a. Telecommunications Bonding Conductor (TBC)
    - b. Primary Bonding Busbar (PBB)
    - c. Telecommunications Bonding Backbone (TBB)
    - d. Secondary Bonding Busbar(s) (SBB)
    - e. Rack mount Telecommunications Grounding Busbar(s)
    - f. Bonding Conductor(s) (BC)
    - g. Bonding Connectors
    - h. Bonding system labeling and administration as defined in Section 270553.

### 1.8 PROJECT RECORD DOCUMENTS

- A. Submit documents under the provisions of Section 270500.
- B. Provide final system block diagram showing any deviations from approved shop drawing submittal.
- C. Provide floor plans that document the following:
  - 1. Actual locations of system components, devices, and equipment.
  - 2. Actual conductor routing.
  - 3. Actual system component, device, equipment, and conductor labels.
- D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.
- E. Complete all operation and maintenance manuals as described below.

### 1.9 OPERATION AND MAINTENANCE DATA

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- A. Submit under provisions of Section 270500.

**PART 2 - PRODUCTS**

**2.1 BONDING CONDUCTORS**

- A. Bare Copper:
  - 1. Annealed uncoated stranded conductor.
  - 2. Minimum size 6 AWG.
- B. Insulated Copper:
  - 1. Annealed uncoated stranded conductor.
  - 2. Insulation:
    - a. PVC insulation with nylon outer jacket.
    - b. Rated at 600 volts.
    - c. Green.
  - 3. Minimum size 6 AWG.
- C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.
- D. Bonding Conductor Sizing:
  - 1. All communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

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E. The TBC shall be the same size as the TBB or larger.

### 2.2 BONDING CONNECTORS

A. Acceptable Types:

1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.

C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

### 2.3 GROUNDING BUSBAR (PBB AND SBB)

A. Features:

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-D standards.
4. Predrilled holes.
5. Integral insulators.
6. Stainless steel offset mounting brackets.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Refer to drawings for grounding busbar size(s).
  - a. Minimum Dimensions: Refer to drawings.
  - b. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
  - c. Hole patterns on busbars accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

### 2.4 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

A. Features:

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1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
  2. Predrilled holes.
  3. Mounts in a standard 19" equipment rack.
- B. Specifications:
1. Material: Electrolytic tough pitch copper bar with tin plating.
  2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.
    - a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
  3. Hole pattern shall include:
    - a. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. General Bonding Requirements:
1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
  2. A licensed electrician shall perform all bonding.
  3. Comply with the manufacturer's instructions and recommendations for installation of all products.
- B. Main Cross Connect and Service Entrance Room Bonding Requirements:
1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.
  2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
  3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.
  4. In service entrance rooms where the entrance pathway contains an isolation gap, the pathway on the facility side of the gap shall be bonded to the PBB.
- C. Where the service entrance cable contains a shield, the shield(s) shall be bonded to the PBB using manufacturer-approved hardware.
- D. Primary Bonding Busbar (PBB) Requirements:

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1. Install PBB such that it is insulated from its support with a minimum 2" standoff.
  2. Bond the PBB to the electrical service ground via the TBC.
    - a. A minimum of 1 foot separation shall be maintained between the TBC and any DC power cables, switchboard cable, or high frequency cables.
  3. Where backbone or horizontal cabling contains a shield, the shield(s) shall be bonded to the PBB.
  4. PBB shall be bonded to all electrical panels located in the same room or space as the PBB. PBB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the PBB.
  5. PBB shall be bonded to accessible metallic building structure located within the same room or space as the PBB.
  6. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the PBB, shall be bonded to the PBB.
  7. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the PBB, shall be bonded to the PBB.
- E. Secondary Bonding Busbar (SBB) Requirements:
1. Provide a SBB in each telecommunications equipment room.
  2. Install SBB such that it is insulated from its support with a minimum 2" standoff.
  3. Bond each SBB to the PBB via the TBB.
    - a. A minimum of 1 foot separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
    - b. The TBB may be routed from PBB to SBB or as a radial feed to each SBB as the layout requires.
  4. If more than one (1) SBB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
  5. Where horizontal cabling contains a shield, the shield(s) shall be bonded to the SBB.
  6. SBBs shall be bonded to accessible metallic building structure located within the same room or space as the SBBs.
  7. SBBs shall be bonded to all electrical panels located in the same room or space as the SBB. SBBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the SBB.
  8. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located

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within the same room or space as the SBB, shall be bonded to the SBB.

9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the SBB, shall be bonded to the SBB.

### F. Rack Bonding Busbar Requirements (RBB):

1. Provide a rack-mount telecommunications ground bar in each equipment rack.
2. Install RBB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RBB and equipment rack.
3. Bond each RBB to the PBB/SBB via a telecommunications equipment bonding conductor (TEBC).
4. If more than one (1) RBB is provided within the same room or space, they shall all be bonded together via a TEBC.
5. Where horizontal cabling containing a shield is terminated on rack-mounted termination hardware, the shield(s) shall be bonded to the RBB.
6. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, fiber optic distribution enclosures, splice enclosures, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RBB, shall be bonded to the RBB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RBB via a dedicated unit bonding conductor (UBC) for each device.

### G. Metallic Interior Communication Pathway Bonding Requirements:

1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.

### H. Bonding Conductor Requirements:

1. Bonding conductors shall be green or marked with a distinctive green color.
2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
3. Bonding conductors shall not be installed in metallic conduit.
4. All conductors, including, but not limited, to the TBC, TBB, BBC, and TEBC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.



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- a. Where documented permission to splice a conductor is granted:
    - 1) The number of splices shall be limited to as few as possible.
    - 2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
    - 3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
    - 4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.
  5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 0553. In addition to the requirements of Section 27 0553:
    - a. Labels shall be nonmetallic.
    - b. Labels shall be printer-generated.
    - c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
    - d. Additionally, conductors shall be labeled as follows:
      - 1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."
  6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
  7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.
- I. Bonding Connection Requirements:
1. Make all connections in accessible locations to facilitate future inspection and maintenance.
  2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
  3. Thoroughly clean conductors before installing lugs and connectors.
  4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.

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5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

### 3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Section 27 0500.
- B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.
- C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

### 3.3 ADJUSTING

- A. Adjust work under provisions of Section 27 0500.
- B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

### 3.4 TESTING

- A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.
  1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
  2. The preferred measured resistance to ground for the grounding electrode system is 10 ohms or less. Refer to Division 26 for exact project requirements.
  3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.
- B. Two-point Ground/Continuity Test:
  1. Two-point ground continuity test shall be performed per TIA-607D standards.

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2. Contractor shall use an earth ground resistance tester to confirm a resistance of less than 100 milliohms between the building's electrical grounding electrode system and any other point in the telecommunications bonding system.
  3. At a minimum, perform tests in the following areas:
    - a. PBB to the electrical ground in distributors
    - b. Each SBB to the electrical ground in distributors
    - c. PBB/SBB to the structural metal (if present)
    - d. PBB to SBB(s)
    - e. Structural metal (if present) to the electrical ground
  4. Complete testing prior to installation of Owner-provided equipment.
- C. Measure and document voltage between screen of installed and terminated ScTP, FTP, and/or SSTP horizontal cables and electrical ground of electrical outlet(s) serving the information outlet location area.
1. The voltage between the screen and the ground wire shall not exceed 1.0 V rms, and 1.0 V dc for any installed and terminated ScTP, FTP, and/or SSTP horizontal cables.
- D. Include measurement documentation in test data submitted at completion of project under provisions of Section 271710.

### 3.5 SYSTEM TRAINING

- A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.
1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
  2. The Architect/Engineer shall be presented with the option to attend the training.
  3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.
- B. At a minimum, the following training shall be conducted:
1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the PBB, SBB, or RBB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.

**END OF SECTION 27 0526**

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**SECTION 27 0528  
INTERIOR COMMUNICATION PATHWAYS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire mesh support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.
- B. Wire mesh support systems are defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

**1.2 RELATED WORK**

- A. Section 26 0533 - Conduit and Boxes
- B. Section 27 0500 - Basic Communications Systems Requirements
- C. Section 27 0526 - Communications Bonding

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 270500 for requirements.

**1.4 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code
- B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

**1.5 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
  - 1. Include cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 0500 for coordination drawing requirements.

**1.6 DRAWINGS**

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

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### PART 2 - PRODUCTS

#### 2.1 CONDUIT

- A. Refer to Section 26 05 33 for conduit requirements for this project.

#### 2.2 WIRE MESH CABLE TRAY - OVERHEAD

- A. General: Provide wire mesh of types and sizes indicated on drawings; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Provide drop-out fittings where cable tray is installed over equipment racks. Two drop-out fittings shall be installed over each rack so that a controlled radius is maintained into each side of every equipment rack that cable tray passes over. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- B. Wire mesh shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire mesh sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
- C. Materials and Finishes: Material and finish specifications for each wire mesh type are as follows:
  - 1. Electro-Galvanized Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633 SC2. [Additionally, straight sections shall be painted] [ Computer White][ Flat Black][ Telco Gray].
- D. Type of Overhead Wire Mesh Support System:
  - 1. All straight section longitudinal wires shall be straight (with no bends).
  - 2. Wire mesh supports shall be trapeze hangers or wall brackets. Center hung supports will not be allowed.
  - 3. Trapeze hangers are to be supported by 1/4 inch or 3/8-inch diameter rods.
  - 4. Provide manufacturer approved grounding clips as necessary for continuous grounding of tray.
  - 5. Basis of Design
    - a. nVent Caddy WBTray "Shaped" WBT#x# S Series
  - 6. Additional acceptable manufacturers:
    - a. Cooper B-Line "Flextray"
    - b. Cablofil, Inc,

#### 2.3 CABLE HANGERS AND SUPPORTS

- A. Provide a non-continuous cable support system suitable for use with open cable.
- B. Cable Hooks:

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1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
  2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
  3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use[ zinc plated steel, ASTM B633 SC3 suitable for heavy duty use. Provide stainless steel AISI Type 304 hooks for corrosive locations].
- C. Cable Hangers:
1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
  2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
  3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.
  4. Cabling hanger load limit shall be 100 lbs per foot.
  5. Manufacturer:
    - a. Erico Caddy
    - b. Arlington Fittings TI Series
    - c. Or approved equal.

### 2.4 INNERDUCT - CORRUGATED

- A. Fabricated from self-extinguishing high-impact polyvinyl chloride (PVC), orange in color.
- B. Fittings and accessories fabricated from same material as conduit and usable with rigid nonmetallic conduit.
- C. Solvent-cement type joints as recommended by manufacturer.
- D. Inside diameter not less than that of rigid steel conduit.
- E. Dielectric strength a minimum of 400 volts per mil.
- F. Corrugated wall construction.
- G. Pull rope pre-installed by manufacturer.
- H. Innerduct installed within buildings (not including riser paths) or utility tunnels shall meet all the above General requirements plus:
  1. Be fabricated of flame-retardant materials (plenum rated) suitable for installation in such environments.

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2. Meet or exceed all requirements for flame resistant duct as required by Bellcore TR-NWT-000356 (Section 4.33).

### **PART 3 - EXECUTION**

#### **3.1 INNER DUCT INSTALLATION REQUIREMENTS**

- A. Inner duct shall be riser or plenum rated as required by the installation environment. At minimum, inner duct should extend to the ladder rack above the termination enclosure at system endpoints. Where not installed in a continuous length, inner duct segments should be spliced using couplings designed for that purpose.
- B. All exposed inner duct is to be labeled at 35-foot intervals with tags indicating ownership, the cable type (e.g., "Fiber Optic Cable") and the cables it contains (e.g., MA-CS or FS-CS).
- C. Where exposed, fiber optic cable shall be installed in protective inner duct.
- D. Contractor shall determine optimum size and quantity to satisfy the requirements of the installation and to ensure that the mechanical limitations, including minimum bend radius of the cable, are considered.
- E. The inner duct should extend into the termination enclosure at system endpoints.

#### **3.2 CABLE HOOK SUPPORT SYSTEM**

- A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.
- B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.
- C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".
- D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
- E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.
- F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.
- G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

#### **3.3 CONDUIT AND CABLE ROUTING**

- A. Refer to Section 260533 for additional requirements.
- B. All conduits shall be reamed and shall be installed with a nylon bushing.

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- C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
- D. No conduit or sleeve containing more than two (2) cables shall exceed[ 40%] [Insert] fill ratio, regardless of length.
- E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.
  - 1. A separate pull box is required for each 90' (or greater) length section.
  - 2. A separate pull box is required after any two (2) consecutive 90-degree bends.
  - 3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.
- F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.
- G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

### 3.4 WIRE MESH TRAY INSTALLATION

- A. The wire mesh cable tray system shall be only for telecommunications.
- B. Install wire mesh as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- C. Cable tray sections shall be grounded in accordance with manufacturer's recommendations using manufacturer approved hardware. Painted sections shall have paint removed at each grounding attachment point.
- D. Test wire mesh support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA 70B, Chapter 18, for testing and test methods.
- E. Provide sufficient space encompassing wire mesh to permit access for installing and maintaining cables.
- F. Tray shall be continuous from source to termination and shall not change elevation, direction or otherwise expose cables to travel without 2" x 4" mesh support.
- G. Overhead Tray shall be field cut using only manufacturer approved cutting device and methods. Cutting device shall be an offset blade bolt cutter; standard bolt cutters are specifically not permitted. [Drop-in tray sections shall not be field cut or field modified in any way.]
- H. Bends in overhead tray shall be accomplished by utilizing manufacturer's cutting guides.

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- I. All splices of tray shall be provided with splice washers, bars or springs as recommended by the manufacturer.

### 3.5 ATTACHMENT TO METAL DECKING

- A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

**END OF SECTION 27 0528**

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**SECTION 27 0543  
EXTERIOR COMMUNICATION PATHWAYS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

**1.2 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for relevant standards.

**1.3 REFERENCES**

- A. Section 27 0500 - Basic Communications Systems Requirements.
- B. ANSI/ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.
- D. ASTM A48 - Gray Iron Castings.
- E. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.
- B. Manhole submittal (if applicable): Indicate material specifications, dimensions, capacities, size and location of openings, reinforcing details, and accessory locations.
  - 1. Provide product data for manhole accessories.
- C. Submit shop drawings and product data under provisions of Section 27 0500.
- D. Submit manufacturer's installation instructions under provisions of Section 27 0500.
- E. Coordination Drawings:
  - 1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 27 0500 for coordination drawing requirements.

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### 1.5 REGULATORY REQUIREMENTS

- A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

### PART 2 - PRODUCTS

#### 2.1 OUTSIDE PLANT CONDUIT

- A. Rigid Metallic Conduit (RMC) and Fittings:
  - 1. Rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
  - 2. Fittings and Conduit Bodies:
    - a. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
    - b. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
    - c. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
    - d. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
    - e. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.
  - 3. Manufacturers:
    - a. Allied
    - b. Or pre-approved equal
- B. Rigid Non-Metallic Conduit (RNC) and Fittings:
  - 1. UL listed, NEMA TC2 and TC6 Schedule 40 or 80 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement.
  - 2. Fittings: NEMA TC3 and TC9, sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
  - 3. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.
  - 4. Manufacturers:
    - a. Carlon (Lamson & Sessions) Type 40

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- b. Cantex
- c. or pre-approved equal

C. High-Density Polyethylene (HDPE) Conduit:

1. Minimum Size: 2 inches, unless noted otherwise.
2. Acceptable Manufacturers:
  - a. Carlon
  - b. Chevron Phillips Chemical Company
  - c. or pre-approved equal.
3. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

ASTM Test	Description	Values HDPE
D1505	Density g/CM 3	Less than 0.941
D1238	Melt Index, g/10 min Condition E	Greater than 0.55 grams/10 min.
D638	Tensile Strength at yield (psi)	3000 min.
D1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D790	Flexural Modulus, MPa (psi)	Less than 80,000
D746	Brittleness Temperature	-75°C Max

4. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
5. Fitting and Conduit Bodies:
  - a. Directional Bore and Plow Type Installation: Electrofusion or universal aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
  - b. For All Other Types of Installation: Coupler must provide a watertight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
  - c. E-loc type couplings are not acceptable in any situations.
  - d. Acceptable Manufacturers:
    - 1) ARCON
    - 2) Carlon
    - 3) or approved equal.

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### D. Fittings:

1. Sweeps: Factory manufactured RMC wrapped with 4 mil vinyl tape with a bend radius as follows:
  - a. Conduit internal diameter of 2" or less is 6 times the internal conduit diameter.
2. End Caps (Plugs): Pre-manufactured and watertight. Tape is not an acceptable end cap or cover.

## 2.2 PRECAST CONCRETE MAINTENANCE HOLES

A. Precast Concrete: Air-entrained, 4000 psi compressive strength at 28 days.

### B. Type:

1. Construction: In modular sections with tongue and groove joints.

C. Shape: As indicated on the drawings.

### D. Requirements:

1. Precast extensions needed to reach grade shall comply with the above requirements.
2. Include 36-inch diameter grooved opening in top section.
3. Necking and Shaft Sections: 30-inch diameter clear opening.
4. Include 12-inch drain opening and two (2) one-inch ground rod openings in base section.
5. Include cable pulling irons opposite each duct entry window.
6. Include precast maintenance hole steps at 16 inches on center.

### E. Acceptable Manufacturers

1. Jensen Precast.
2. E.C. Babbert.
3. Pre-approved equal.

## 2.3 CAST-IN-PLACE MAINTENANCE HOLES

A. Concrete: 4000 psi compressive strength at 28 days in conformance with requirements of Division 3.

B. Provide reinforcing under the provisions of Division 3.

## 2.4 MAINTENANCE HOLE ACCESSORIES

A. Maintenance Hole Frames and Covers: ASTM A48; Class 30B gray cast iron, machine finished with flat bearing surfaces.

B. Sump Covers: ASTM A48; Class 30B gray cast iron.

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- C. Pulling Irons: 7/8-inch diameter steel bar forming a triangle of 9 inches per side when set. Galvanize to ANSI/ASTM A153 for irregular shaped articles.
- D. Cable Rack Inserts: Steel channel insert with minimum load rating of 800 pounds length to match cable rack channel.
- E. Cable Rack Channel: 4 X 1-1/2 X 3/16-inch steel channel wall bracket, 48-inch length, with cable rack arm mounting slots on 8-inch centers.
- F. Cable Racks: ANSI/ASTM A569; steel channel, 2-1/2 X 14 inches with high-glazed wet-process porcelain insulators.
- G. Manhole Steps: Cast iron, suitable for manhole shape, construction and meeting OSHA requirements.
- H. Manhole Ladders: Fiberglass, suitable for manhole shape, height, construction and meeting OSHA requirements.

### 2.5 HAND-HOLES

- A. Type:
  - 1. Polymer concrete
- B. Dimensions:
  - 1. [Insert]X[Insert]X[Insert],[ As indicated on the drawings.]
- C. Requirements:
  - 1. Includes polymer concrete cover.
- D. Acceptable Manufacturers
  - 1. Quazite

### 2.6 TEXTILE INNERDUCT

- A. Contractor shall provide and install innerduct in each conduit identified to have copper and fiber optic cable installed.
- B. Innerduct shall have an 18 gauge solid copper core tracer wire installed into each cell to allow for detection by industry standard toning equipment.
- C. Each innerduct cell shall have a pull tape installed.
- D. Acceptable Manufacturers:
  - 1. Maxcell
  - 2. or pre-approved equal.

### 2.7 HEAVYWALL INNERDUCT

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A. General Requirements:

- 1. Innerduct shall be produced from a suitable thermoplastic polymer conforming to the minimum standards for polyethylene as defined by ASTM.
- 2. Innerduct shall be high density, high impact resistant, abrasion resistant, and flexible with a low friction factor and light weight.

B. Mechanical Requirements:

- 1. Innerduct shall have corrugated walls and shall be free from holes, splits, blisters, inclusions, and other performance-affecting imperfections.
- 2. Innerduct bore shall be free from dimensional non-uniformities, and wall thickness shall be concentric.

SIZE	OD	ID
1"	1.375" (Max.)	1.0" (Min.)
1-1/4"	1.67" (Max.)	1.25" (Min.)
1-1/2"	2.0" (Max.)	1.5" (Min.)

**2.8 UNDERGROUND WARNING TAPE**

- A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
- B. Overall Thickness: 5 mils.
- C. Foil Core Thickness: 0.35 mil.
- D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION  $\infty$  BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.
- E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- F. Comply with ANSI Z535.1 through ANSI Z535.5.

**PART 3 - EXECUTION**

**3.1 INSTALLATION - DUCTBANK**

- A. Make duct bank installations and penetrations through foundation walls watertight.
- B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.
- C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.

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- D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and hand-holes.
- E. Where ducts enter structures such as manholes, hand-holes, pullboxes and buildings, terminate the ducts in suitable end bells.
- F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.
- G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.
- H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

### 3.2 INSTALLATION - HAND-HOLES

- A. Install gravel drainage bed a minimum of 6" depth below hand-hole using a minimum gravel size of 1 inch.
- B. Provide units and/or extensions as required by conduit depth for hand-hole cover to be flush with finished grade.
- C. Slope grade away from cover with a slope of approximately 1 inch in 3 feet.
- D. Conduit entry penetrations shall not exceed 25% of side wall area.

### 3.3 INSTALLATION - TEXTILE INNERDUCT

- A. Provide two (2) 3-cell innerducts per 4" conduit or as recommended by the manufacturer.
- B. Install innerduct per manufacturer's guidelines.
- C. Cut and tie off innerduct and pull tape inside each communications vault or Entrance Room.

### 3.4 EXCAVATION, FILL, BACKFILL, COMPACTION

- A. General:
  - 1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.
- B. Excavation:
  - 1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
  - 2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.



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3. Excavations shall be protected against frost action and freezing.
4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.

### C. Dewatering:

1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.

### D. Underground Obstructions:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.

### E. Fill and Backfilling:

1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
2. The Contractor shall provide the necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.

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6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. Native soil materials may be used as backfill if approved by the Geotechnical Engineer. All other conduit shall have sand backfill to 6" above the top of the conduit.
8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

### 3.5 RESTORATION REQUIREMENTS

- A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching.

**END OF SECTION 27 0543**

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**SECTION 27 0553  
IDENTIFICATION AND ADMINISTRATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.
- B. Identification and labeling.
- C. Administration of structured cabling system, utilizing identifiers, records, record linkages and presentation.
  - 1. Identifier: Information that links a specific element of the telecommunications infrastructure with its corresponding record.
  - 2. Records: A collection of detailed information related to a specific element of the telecommunications infrastructure.
  - 3. Record Linkage: A connection between a record and an identifier or between records.

**1.2 RELATED WORK**

- A. Section 27 0500 - Basic Communications Systems Requirements

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for relevant standards.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Documentation of labeling scheme.
  - 2. Complete documentation of nomenclature for all Administration components.

**PART 2 - PRODUCTS**

**2.1 ADMINISTRATION**

- A. Administrative requirements include identifiers, records, record linkages and labeling for the purposes of administering building cabling, pathways and spaces and grounding/bonding within a facility.
- B. The administrative system shall be developed in Microsoft Word format or other electronics program approved by the Architect/Engineer. Should the Contractor elect to provide documentation of the administrative system in a proprietary format, the owner shall be provided with a retail licensed version of the software by the Contractor allowing the full editing and reading the documentation.
- C. Refer to the Administrative System Outline below for minimum requirements.

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### D. Identifiers:

1. Identifiers shall be marked at the equipment to be administered.
2. Identifiers shall be unique for each type of equipment. For example, in no case shall the identifier for a cable be the same as the identifier for a pathway.

### E. Records:

1. Provides descriptive information about the identified equipment.

### F. Linkages:

1. To be used to describe the connection between an identifier and a record. In addition, a linkage is used to point from one record to another record.

### G. Presentation of Administrative System:

1. Provide reports cataloging the records for all equipment.
2. Provide reports showing the labeling scheme for all components of the Administrative system.

### H. Administrative System Outline:

1. The format of the outline is as follows:
  - a. Subsystem:
    - 1) Required identifiers
    - 2) Linked records.
2. Pathways:
  - a. Pathway identifier, type, fill, loading.
  - b. Cable records, space records, pathway records, grounding records.
3. Spaces:
  - a. Space identifier, space type
  - b. Pathway records, cable records, grounding records.
4. Cable:
  - a. Cable identifier, cable type, total pair count, damaged pair count, unterminated pair count.
  - b. Termination records, splice records, pathway records, grounding records.
5. Cabling Termination Hardware:
  - a. Termination identifier, hardware type, damaged position numbers.

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- b. Termination position records, space records, grounding records.
- 6. Termination Position:
  - a. Termination position identifier, termination type.
  - b. Cable records, termination hardware records, space records.
- 7. Splice:
  - a. Splice identifier, splice type
  - b. Cable records, space records.
- 8. Telecommunications Main Ground Bar:
  - a. TMGB identifier, busbar type, grounding conductor identifier
  - b. Bonding conductor records, space records.
- 9. Bonding Conductors:
  - a. Bonding conductor identifier, conductor type, busbar identifier
  - b. Grounding busbar records, pathway records.
- 10. Telecommunications Ground Bar:
  - a. TGB identifier, busbar type
  - b. Bonding conductor records, space records.

### 2.2 LABELING

- A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.
- B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.
- C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface an attachment method.
- D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.
  - 1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quite zone" of 0.25" on each side of the bar code.
  - 2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.
- E. Color Code: Observe the following requirements for color coding:

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1. Labels on each end of a cable shall be the same color for each termination.
  2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.
  3. Orange (Pantone 15C) shall be used for the demarcation point.
  4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.
  5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)
  6. White shall be used to identify the first-level backbone termination in the main cross-connect.
  7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.
  8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.
  9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.
  10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.
  11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.
  12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.
- F. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).
  2. "Outlet Number" shall start with 1 in each room, with additional outlets in each room numbered sequentially.
  3. "Jack Number" shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
  4. "Use" shall be designated by the following:
    - a. "D" for data (RJ-45)
    - b. "C" for video (coax)
    - c. "M" for multimedia retrieval (coax)
    - d. "S" for speaker (RCA)

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5. Example #2: "109-3-4-D" indicates the bottom right data jack (assuming a 4-port faceplate) in outlet #3 in Room 109.
- G. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:
  1. (Telecom Room Number) - (Patch Panel Letter) - (Patch Panel Port Number).
  2. "Telecom Room Number" shall be as indicated on the drawings.
  3. "Patch Panel Letter" shall start with 'A' for the top modular patch panel, increasing sequentially from top to bottom across the equipment rack.
  4. "Patch Panel Port Number" shall start with '1' for the upper left port in each modular patch panel, increasing sequentially from left to right and top to bottom across the modular patch panel face.
  5. Example #1: MC/1-A3 indicates the third modular patch panel port in modular patch panel 'A' in Main Equipment Room (MC/1).
  6. Example #2: HC/2-C39 indicates the thirty-ninth modular patch panel port in modular patch panel C in Horizontal Cross-Connect room (HC/2).

### 2.3 DOCUMENTATION/AS-BUILTS/RECORDS

#### A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

#### B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

## PART 3 - EXECUTION

### 3.1 IDENTIFICATION AND LABELING

#### A. Cable Labeling: Backbone and horizontal cables shall be labeled at each end.

1. Provide additional cable labeling at each manhole and pull box.
2. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
3. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue

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with a white stripe to indicate the higher performance class station cabling.

- B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.
- C. Termination Hardware Labeling:
  - 1. An identifier shall be provided at each termination hardware location or its label.
- D. Grounding/Bonding Labeling:
  - 1. The TMGB shall be labeled "TMGB." There shall be only one TMGB in the facility.
  - 2. Label all TBB conductors connecting to the TMGB with a unique label, located at both ends of the TBB.
  - 3. Each TGB shall be labeled with a unique label.
  - 4. All TBB conductors connecting to the TGB shall be labeled uniquely at each end of the cable.

### 3.2 ADMINISTRATION

- A. Provide administrative documentation of cabling, termination hardware, termination positions, splices and grounding as described above.
- B. Identifiers:
  - 1. Cable Identifiers: Provide a unique identifier for each cable serving as a link to the cable record. The identifier shall be marked on the cable or on the cable label.
  - 2. Termination Hardware Identifiers:
    - a. Provide a unique identifier for each termination hardware unit, serving as a linkage the unit record.
  - 3. Termination Position Identifiers:
    - a. A unique identifier shall be provided to each termination position to serve as a link to the termination position record.
    - b. An identifier shall be marked on each position label. Each termination position shall be marked with the termination position identifier.
  - 4. Splice Enclosure Identifier:
    - a. Provide a unique identifier for each splice enclosure to serve as a link to its record.
  - 5. Grounding/Bonding Identifiers:
    - a. The TMGB shall be marked "TMGB". Only one TMGB shall be located in a facility.
    - b. Provide a unique identifier for each TBB attached to the TMGB.
    - c. A unique identifier shall be provided for each TBG in a facility.

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d. Provide a unique identifier for each TBB attached to the TBG.

### C. Records:

1. Cable Records: Provide cable identifier, cable type, conductor quantity, damaged conductor quantity, unterminated conductor quantity, available conductor quantity.
  - a. The cable type field shall include the manufacturer and manufacturer's catalog designations, including ratings.
  - b. Termination position linkage fields shall be included.
2. Termination Hardware Records: Provide hardware identifier, hardware type, damaged position numbers, available position numbers.
  - a. Provide linkages to termination position records, space records, and grounding records.
3. Termination Position Records: Provide termination position identifier, cable conductor numbers.
  - a. Provide linkages to cable records, termination position records, termination hardware records and space records.
4. Splice Records: Indicate the splice identifier and the type.
  - a. Provide linkages to cable records and space records.
5. Grounding/Bonding Records:
  - a. TMGB Record: Provide TMGB identifier, busbar type, grounding conductor identifier.
    - 1) Provide linkage to bonding conductor records and space records.
  - b. TBB Records: Provide TBB identifier, conductor type, and busbar identifier.
    - 1) Provide linkage to busbar and pathway records.
  - c. TGB Records: Provide TGB identifier, busbar type.
    - 1) Provide linkage to bonding conductor records and space records.

**END OF SECTION 27 0553**

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**SECTION 27 1100  
COMMUNICATION EQUIPMENT ROOMS (CER)**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

**1.2 RELATED WORK**

- A. Section 27 0500 - Basic Communications Systems Requirements
- B. Section 27 0526 - Communications Bonding
- C. Section 27 0528 - Interior Communication Pathways
- D. Section 27 1500 - Horizontal Cabling Requirements

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for applicable standards.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.
- B. Coordination Drawings:
  - 1. Include ladder racking, equipment racks, cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 0500 for coordination drawing requirements.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT GROUNDING**

- A. Refer to specification section 27 0526 for grounding requirements.
- B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

**2.2 EQUIPMENT RACKS AND CABINETS**

- A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.

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- B. The equipment rack shall conform to the following requirements:
1. Standard TIA/EIA 19" Floor Rack:
    - a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 3/4").
    - b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
    - c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.
    - d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
    - e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
    - f. Provide all mounting hardware and accessories as required for a complete installation.
  2. Swing Gate TIA/EIA 19" Wall Rack:
    - a. Equipment rack shall be 35" in height and provide a useable mounting height of 19 RU. Rack shall be a minimum of 25" deep.
    - b. Wall-mounted equipment racks shall be provided with a swing-gate assembly to allow rear access of rack-mounted equipment.
    - c. Equipment rack shall support up to 150 lbs. when securely mounted to a wall or backboard.
    - d. Provide all mounting hardware and accessories as required for a complete installation.
  3. Standard TIA/EIA 19" Floor Cabinet:
    - a. The equipment cabinets shall be constructed of painted steel or aluminum and offer a usable mounting height of 45 RU. Rack shall be a minimum of 31 inches deep.
    - b. The equipment cabinet shall be equipped with a lockable steel front door and furnished with two (2) keys that shall be usable on all cabinets furnished under this Contract.
    - c. The equipment cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments and be spaced to accommodate industry standard 19-inch mounting. Cabinet shall be tapped to accept 12-24 screws.
    - d. The equipment cabinet shall be vented to allow for airflow through the cabinet.

### 2.3 CABLE MANAGEMENT - VERTICAL AND

- A. Equipment Racks:
1. Equipment racks shall be equipped with vertical cable management hardware in the form of rings and guides. Racks shall incorporate vertical covers, to allow an orderly, hidden, routing of copper,

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optical fiber, and coax jumpers from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical cable management hardware shall be as follows:

- a. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 14" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.
2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

### B. Equipment Cabinets

1. Equipment cabinets shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, to allow an orderly routing of optical fiber and copper jumpers from the modular patch panel and/or 110-type termination blocks to the customer provided network electronics. At a minimum, one such horizontal cable management panel shall be provided with each equipment cabinet. Horizontal cable management panels shall be 3.5" in height and have a minimum of five (5) jumper distribution rings.

## 2.4 PATCH PANELS

- A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.
- B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 1500. On wall-mounted panels, this interface shall be accessible from the front of the panel.
- C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.
- D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.
- E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

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## 2.5 OPTICAL FIBER PANELS

- A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted.
- B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.
- C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.
- D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.
- E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1/2", whichever is larger.
- F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.
- G. Where "Loose Buffered" cables are installed, the 250  $\mu\text{m}$  coated optical fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtailed") or (2) the use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g., Kevlar<sup>®</sup>) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers. Direct termination of 250  $\mu\text{m}$  coated optical fibers shall not be permitted.
- H. Fiber distribution cabinets for horizontal cabling: Where optical fiber horizontal cabling is to be terminated, the enclosure shall be compliant to all the above requirements plus the enclosure shall incorporate a storage mechanism designed to allow simplified identification, access to and termination of individual optical fibers. This may be in the form of a storage cassette, tray or other appropriate mechanism.

## 2.6 OPTICAL FIBER COUPLERS/ADAPTERS

- A. Optical Fiber Couplings (LCtype) (Multimode/Singlemode):

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1. LC-type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
2. LC-type optical fiber couplings shall be snap-type with locking washer and nut.
3. LC-type optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.
6. LC-type optical fiber couplings shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

B. Performance Requirements:

1. Length: 2 inches
2. Operating Temperature: -40 to 85 degrees C
3. Basis of Design:
  - a. Corning

### 2.7 LADDER RACK

- A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.
- B. Tubing Style Ladder Rack:
  1. Rolled steel siderail stringer, minimum 1.5" stringer height, 9" spaced welded rungs.
  2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
  3. Loading limits shall be 185 lbs/ft for 4 ft spans.
- C. Ladder rack finish shall be flat black powder coat.

### 2.8 D-RINGS

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- A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.
- B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.
- C. Provide 1/4" screw holes for wall mounting.

### 2.9 POWER STRIPS

- A. Provide power strips on all equipment racks, unless noted otherwise. These power strips shall have the following characteristics:
  - 1. Standard Rack Mount:
    - a. TIA/EIA 19" equipment rack mountable.
    - b. Compliant with UL-1449 Third Edition and UL-497A.
    - c. Provide transient suppression to 12,000-A. Protection shall be in all three modes (line-neutral, line-ground and neutral-ground).
    - d. Shall meet or exceed ANSI C62 Category A3 requirements.
    - e. Provide high-frequency noise suppression as follows:
      - 1) Greater than 20-dB @ 50 kHz
      - 2) Greater than 40-dB @ 150 kHz
      - 3) Greater than 80-dB @ 1 MHz
      - 4) Greater than 30-dB @ 6 to 1000 MHz
    - f. Protection Modes and UL 1449 Clamping Voltage: 475 volt L-N, L-G, and N-G.
    - g. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
    - h. Be equipped with a 10-foot power cord.

### 2.10 COPPER PATCH CORDS

- A. Modular Patch Panel:
  - 1. Provide Category 6 Category 6A copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
  - 2. Refer to Section 271500 for cable and connector performance requirements.
  - 3. Patch cords shall not be made-up in the field.
  - 4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

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### 2.11 FIBER PATCH CORDS

#### A. Optical Fiber Patch Cords (Singlemode):

1. The optical fiber patch cord shall be 8.3/3 mm singlemode (SM) optical fiber, utilizing tight buffer construction. The optical fiber patch cords shall be a minimum of 5 feet in length.
2. Provide 8.3/3 mm singlemode (SM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped [ LC ][ ST ][ SC ][ MT-RJ ]-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
3. Channels shall be of equal length.
4. Refer to Section 271500 for cable and connector performance requirements.
5. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

- a. Corning

### 2.12 DEMARCATION REQUIREMENTS

- A. Contractor shall coordinate all requirements for the demarcation point with the Owner's selected service provider.
- B. The Contractor shall not proceed with any installation without written communication with the Architect/Engineer should the service provider's requirements differ from the work shown on the contract documents.
- C. Refer to the drawings for further requirements.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT RACKS

- A. Equipment racks shall be furnished and installed as shown on the drawings.
- B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.
- C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.

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- D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.
- E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.
- F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

### 3.2 LADDER RACK

- A. Provide support for ladder rack on 4 ft centers.
- B. Maintain a 1.5 safety factor on all load limits specified herein.
- C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

### 3.3 D-RINGS

- A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.
- B. Locate D-rings on 24" centers vertically and horizontally.
- C. Securely attach D-rings to the wall as required by the manufacturer.

### 3.4 GROUNDING

- A. Provide a complete grounding system in accordance with the requirements of Section 270526.

### 3.5 CROSS CONNECT INSTALLATION

- A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.
- B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.
- C. The cable jacket shall be maintained as close as possible to the termination point.
- D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

### 3.6 OPTICAL FIBER TERMINATION

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- A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.
- B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.
- C. Each cable shall be clearly labeled at the entrance to all enclosures.
- D. A maximum of 12 strands shall be spliced in any tray.

### 3.7 CONDUITS AND CABLE ROUTING

- A. Refer to Section 26 0533 for additional requirements.
- B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab[ 3" into the room below the raised floor].
- C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.
- D. All conduits shall be reamed and shall be installed with a nylon bushing.
- E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

**END OF SECTION 27 1100**

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**SECTION 27 1300  
BACKBONE CABLING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

**1.2 RELATED WORK**

- A. Section 27 0500 - Basic Technology Systems Requirements.
- B. Section 27 1500 - Horizontal Cabling Requirements.
- C. Section 27 1720 - Structured Cabling System Warranty.

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for relevant standards.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. The basis of design is listed herein. Refer to Section 27 1720 for additional acceptable manufacturers.

**2.2 OPTICAL FIBER BACKBONE - INSIDE PLANT**

- A. Multimode (MM)/Singlemode (SM):
  - 1. This optical fiber backbone cable shall be suitable for installation in building riser systems, in conduit, in cable tray and/or in innerduct.
  - 2. Optical fiber cable materials shall be all dielectric (no conductive material).
  - 3. Optical fiber cable shall carry an OFNR (optical fiber non-conductive riser) or OFNP (optical fiber non-conductive plenum) rating. Refer to Section 270500 for project requirements.
- B. Optical fiber cables suitable for installation in multiple environments (e.g., underground duct and building risers) may be used at the Contractor's option. Such optical fiber cables shall meet all

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specifications noted above for cables designated for each environment through which the optical fiber cable shall pass.

- C. Basis of Design (Singlemode):
  - 1. Hubbell (HFCD15xxx series)
  - 2. Additional acceptable manufacturers.
    - a. Corning

### 2.3 OPTICAL FIBER BACKBONE - OUTSIDE PLANT

- A. During Installation: 2700 N (600 lb. force) (no irreversible change in attenuation).
- B. Long Term: 890 N (200 lb. force).
  - 1. Bending Radius:
    - a. During Installation: 20 times cable diameter.
    - b. No Load: 10 times cable diameter.
- C. Duct Bank (Multimode/Singlemode):
  - 1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
  - 2. Optical fiber cable materials shall be all dielectric (no conductive materials).
  - 3. Optical fiber cable shall be filled with a water-blocking material.
  - 4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
  - 5. Temperature Range:
    - a. Storage: -40°C to +70°C (no irreversible change in attenuation).
    - b. Operating: -40°C to +70°C.
  - 6. Humidity Range: 0% to 100%.
  - 7. Maximum Tensile Strength:
    - a. During Installation: 2700 N (600 lb. force) (no irreversible change in attenuation).
    - b. Long Term: 890 N (200 lb. force).
  - 8. Bending Radius:

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- a. During Installation: 20 times cable diameter.
  - b. No Load: 10 times cable diameter.
9. Basis of Design (Singlemode):
- a. Corning

**D. Optical Fiber Pigtails (Singlemode):**

1. Single-fiber fiber optic pigtails shall be constructed from singlemode (SM) optical fiber of the same grade as the singlemode fiber optic backbone cable utilizing tight buffer construction.
2. Fiber optic pigtails shall be factory terminated with a ceramic tipped [ LC ][ ST ][ SCV ][ MT-RJ ]-type connector on one end and shall be a minimum of 5 feet (1.5m) in length or as indicated on the drawings. Channels shall be of equal length.
3. Connector body shall be of materials similar to that used in the proposed couplings. Refer to Section 271500 for connector performance requirements.
4. Provide in quantity to terminate all backbone fiber optic cable strands on each end.

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

**E. Optical Fiber Connectors (LC-type) (Multimode/Singlemode):**

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm - 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for multimode and single mode connectors
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB

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Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

F. Additional Performance Requirements:

1. Length: 2.23 inches
2. Operating Temperature: -40 to 85 degrees C

**2.4 OPTICAL FIBER BACKBONE PERFORMANCE**

A. Singlemode (SM):

1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.
2. Core Diameter: 8 to 9  $\mu\text{m}$ . All optical fibers shall be of the same nominal core diameter and profile.
3. Cladding Diameter:  $125 \pm 1.0 \mu\text{m}$ .
4. Cladding Non-circularity:  $\leq 1\%$ .
5. Core to Cladding Offset:  $\leq 0.8 \mu\text{m}$ .
6. Fiber Coating Diameter:
  - a.  $245 \pm 15\mu\text{m}$  (primary coating).
  - b. 900-nm (nominal) secondary coating (tight buffer).
  - c. All coatings shall be mechanically strippable without damaging the optical fiber.
7. Cut-off Wavelength (cabled fiber; iccf)  $\leq 1260\text{-nm}$ .
8. Mode Field Diameter: 8.3 to 9.8  $\mu\text{m}$  at 1300-nm;  $10.5 \pm 1.0 \mu\text{m}$  at 1550-nm.
9. Zero Dispersion Wavelength ( $\lambda_0$ ): 1301.5 nm less than 10 less than 1321.5 nm.
10. Zero Dispersion Slope ( $S_0$ ): Less than 0.092 ps/nm<sup>2</sup>\*km.
11. Fiber Attenuation (maximum @  $23 \pm 5^\circ\text{C}$ ; Backbone):
  - a. @ 1550-nm: 1.75 dB/km
  - b. When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.
12. Fiber Dispersion (maximum):
  - a. @ 1285 to 1330-nm: 3.2-ps/nm\*km

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- b. @ 1550-nm: 18-ps/nm\*km
13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

### **PART 3 - EXECUTION**

#### **3.1 CABLE INSTALLATION REQUIREMENTS**

- A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.
- B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, Telecommunications Room or main equipment room, for backbone and intra-building cable.
- C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

#### **3.2 CROSS-CONNECTS**

- A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.
- B. The Owner shall be responsible for the cross-connect wiring between the horizontal and backbone voice cabling.
- C. This Contractor shall not be responsible for cross-connects between the cabling terminations at the Entrance Room and the telephone utility network point-of-presence. It shall be the responsibility of the Contractor, to work with the Owner and provide the necessary assistance to allow Owner and/or telephone company personnel to make the necessary connections to establish service on the new cable system. These activities include, but are not limited to cross-connect documentation, general wiring overview and cable pair identification.

**END OF SECTION 27 1300**

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**SECTION 27 1500  
HORIZONTAL CABLING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

**1.2 RELATED WORK**

- A. Section 27 0500 - Basic Communications Systems Requirements
- B. Section 27 1720 - Structured Cabling System Warranty

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for relevant standards and plenum or non-plenum cable requirements.
- B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).
- C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.
- D. The installing contractor must be certified by the manufacturer of the structured cabling system.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:
  - 1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
  - 2. Manufacturer's installation instructions.

**PART 2 - PRODUCTS**

**2.1 HORIZONTAL CABLE**

- A. CAT 5E Cable:
  - 1. The horizontal cable requirements must be met as well as the following channel requirements.
  - 2. CAT 5E cable shall terminate on **[ rack-mounted ][ 110-type termination blocks ][ modular patch panels ]** in their respective communication equipment room as indicated on the drawings.
  - 3. Performance tests shall be conducted at a maximum test frequency of 250 MHz for the cable and 150 MHz for the channel. All numbers given are dB per 100 meters.

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Test Parameter	100 MHz	250 Mhz
Attenuation:	22.0 dB	36.9 dB
NEXT:	35.3 dB	31.3 dB
PS NEXT:	32.3 dB	28.3 dB
ACR:	13.3 dB	-5.5 dB
PS ACR:	N/A	-8.5 dB
ELFEXT:	23.8 dB	18.8 dB
PS ELFEXT:	20.8 dB	15.8 dB
Return Loss:	20.1 dB	17.3 dB
Propagation Delay:	548 ns	N/A
Delay Skew:	50 ns	25 ns
Test Parameter	100 MHz	150 Mhz
Attenuation:	24.0 dB	30.1 dB
NEXT:	30.1 dB	28.5 dB
PS NEXT:	27.1 dB	25.5 dB
ACR:	6.1 dB	-1.5 dB
PS ACR:	3.1 dB	-4.5 dB
ELFEXT:	17.4 dB	16.3 dB
PS ELFEXT:	14.4 dB	13.3 dB
Return Loss:	10.0 dB	8.2 dB

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	14.0%
NEXT:	7.0dB
PS NEXT:	8.0dB
ACR-F (ELFEXT)	8.0 dB
PS ACR-F (PS ELFEXT):	8.0 dB
Return loss:	4.0 dB

**B. CAT 6 Cable:**

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Performance tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships

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between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 271720 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.

6. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	5.0%
NEXT:	3.0dB
PS NEXT:	5.0dB
ACR-F (ELFEXT)	4.0 dB
PS ACR-F (PS ELFEXT):	50 dB
Return loss:	2.0 dB

7. The jacket color for CAT 6 cable shall be blue for data applications.
8. Basis of Design:
  - a. Uniprise

### 2.2 CONNECTORS/COUPLERS/ADAPTERS

- A. Refer to Section 271100 for requirements and 27 13 00 for requirements.

### 2.3 FACEPLATES/JACKS

- A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.

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6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:
  - a. Match the receptacle color used for other utilities in the building, or
  - b. When installed in surface raceway (if applicable), match the color of that raceway.
8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:
  - a. Be a low-profile assembly.
  - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
  - c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
  - d. Incorporate a shroud that protects the optical fiber couplings from impact damage.
9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.
11. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6 modular jacks shall be pinned per TIA-568B.
13. The color for CAT 6 jacks shall be match cable color.

### 2.4 COPPER WORK AREA CORDS

#### A. RJ-45:

1. Provide the same quantity of Category 6 copper work area cords as copper patch panel cords specified in Section 271100. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
2. Work area cords shall be [10'] [Insert] in length.
3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

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**PART 3 - EXECUTION**

**3.1 CABLE INSTALLATION REQUIREMENTS**

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:
  - a. Twelve (12) inches from power lines of less than 5-kVa.
  - b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
  - c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
  - d. Thirty-nine (39) inches from transformers and motors.
2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12"

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vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

### 3.2 CABLE TERMINATION REQUIREMENTS

#### A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use.[ Modular patch panels shall be sized to accommodate a minimum of [Insert] additional drops].
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

#### B. Cable Terminations - Fiber Optic:

1. ALL fibers shall be terminated using the specified connector type.
2. All terminated fibers at the telecommunications rooms shall be mated to couplings mounted on panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.
3. All couplings shall be fitted with a dust cap.
4. Fibers from multiple locations may share a common enclosure, however, they must be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure provided that they are clearly identified as such. Fibers from different locations shall NOT share a common connector panel (e.g., "insert").
5. Slack in each fiber shall be provided to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30" high workbench positioned adjacent to the termination enclosure(s). A minimum of 1 meter (approximately 39") of slack shall be retained regardless of panel position relative to the potential work area.

**END OF SECTION 27 1500**

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**SECTION 27 1710  
TESTING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

**1.2 RELATED WORK**

- A. Section 27 0500 - Basic Communications Systems Requirements

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 27 0500 for relevant standards.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work, the Contractor shall submit:
  1. Complete information on testing procedure as described herein.
  2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

**PART 2 - PRODUCTS**

**2.1 TESTING COPPER**

- A. General Requirements:
  1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
  2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
  3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
  4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
  5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to

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prove the wiring connections are correct.

6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
  - a. CAT 5E Cable:
  - b. CAT 6 Cable:
    - 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
    - 2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
    - 3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the ["Permanent Link"]["Channel Link"], including [patch cords,] cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
      - (a) Wire Map
      - (b) Length
      - (c) NEXT Loss (Pair-to-Pair)
      - (d) NEXT (Power Sum)
      - (e) ELFEXT (Pair-to-Pair)
      - (f) ELFEXT (Power Sum)
      - (g) Return Loss
      - (h) Attenuation
      - (i) Propagation Delay
      - (j) Delay Skew

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- 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
  - 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
  - 6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS\*, FAIL\*, or FAIL result for any of the parameters will not be accepted.
- c. CAT 6A Cable:
- 1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
  - 2) Horizontal cable shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
  - 3) CAT 6A horizontal cable shall be tested to 500 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the ["Permanent Link"]["Channel Link"], including [patch cords,] cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:
    - (a) Wire Map
    - (b) Length
    - (c) NEXT Loss (Pair-to-Pair)
    - (d) NEXT (Power Sum)
    - (e) ELFEXT (Pair-to-Pair)
    - (f) ELFEXT (Power Sum)
    - (g) Return Loss
    - (h) Attenuation
    - (i) Propagation Delay
    - (j) Delay Skew



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- 4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
- 5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6A modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be used during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
- 6) CAT 6A horizontal cable testing shall be performed using a test instrument designed for testing to 500 MHz or higher. Test records shall verify "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS\*, FAIL\*, or FAIL result for any of the parameters will not be accepted.
- 7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

### 2.2 TESTING FIBER

#### A. General Requirements:

1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.

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7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
  8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
  9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
    - a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
    - b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.
- B. Tests Prior to Installation: The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.
- C. Tests After Installation: Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:
1. Optical Attenuation ("Insertion Loss" Method):
    - a. Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Multimode optical fibers shall be tested at  $850 \pm 30$  nm. Singlemode optical fibers (if applicable) shall be tested at  $1300 \pm 20$  nm.
  2. Verification of Link Integrity (OTDR):
    - a. All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Multimode optical fibers shall be tested at 850-nm and 1300-nm (nominal). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.

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- b. Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
- c. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multimode optical fiber or 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

### 2.3 DOCUMENTATION/AS-BUILTS/RECORDS

#### A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 270500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

#### B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

#### C. Optical Fiber Media Test Data:

1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify

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each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

### D. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

## **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION 27 1710**

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**SECTION 27 1720  
STRUCTURED CABLING SYSTEM WARRANTY**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

**1.2 RELATED WORK**

- A. Section 270500 - Basic Technology Systems Requirements.
- B. Section 271100 - Communication Equipment Room (CER).
- C. Section 271300 - Backbone Cabling Requirements.
- D. Section 271500 Horizontal Cabling Requirements.

**1.3 QUALITY ASSURANCE**

- A. Refer to Section 270500 for relevant standards.

**1.4 SUBMITTALS**

- A. Under the provisions of Section 270500 and Division 1, prior to close of the project the Contractor shall submit:
  - B. A numbered certificate from the manufacturing company registering the installation.

**PART 2 - PRODUCTS**

**2.1 WARRANTY**

- A. A twenty-five (25) year Product Installation Warranty and System Assurance Warranty shall be provided for the structured cabling system as described in the contract documents.
- B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
- C. The system assurance warranty shall cover the failure of the wiring system to support the application it was designed to support, as well as additional applications introduced in the future by recognized standards or user forums that use the TIA/EIA 568A component and link/channel specifications for cabling.
- D. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

**PART 3 - EXECUTION**

**3.1 WARRANTY REQUIREMENTS**

**Structured Cabling System Warranty - 27 1720**

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- A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

**END OF SECTION 27 1720**

**Structured Cabling System Warranty - 27 1720**

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**SECTION 32 8400  
LANDSCAPE IRRIGATION**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. Provide labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein.
- B. Items of work specifically included are:
  - 1. Procurement of applicable licenses, permits, and fees.
- C. Coordination of Utility Locates ("Call Before You Dig"). Telephone 811 or 800.227.2600.
- D. Installation of landscape irrigation system and sleeving for irrigation pipe and wire.
- E. Provision and connection of electrical power supply to irrigation control system as noted on drawings.
- F. Preparation of Record Drawings.
- G. Maintenance period.

**1.2 DISCREPANCIES**

- A. It is the intent of these plans and specifications that the all new equipment installed for the irrigation system will be complete and fully functional prior to final acceptance. It is the Contractor's responsibility to confirm that new equipment furnished is compatible and adheres to all City of Sparks standards.

**1.3 SUBMITTALS**

- A. Equipment and manufacturer listed on the plans is intended to represent specific performance characteristics and operational parameters based on irrigation design. Alternative equipment submitted by contractor will require approval by Landscape Architect and City of Sparks Representatives prior to installation. If alternative equipment or manufacturer is submitted and approved, the contractor takes full responsibility for confirming system performance and operational parameters match those of specified equipment.
- B. Submit to Landscape Architect one PDF copy of shop drawings or manufacturer's "cut sheet" for each type of pipe and tubing, controller and enclosure, valve, emitter, valve box, flow sensor, master valve, wire, wire connector, fitting type, primer and solvent and other equipment to be installed. Include manufacturer name and model number for each proposed item. Re-submit any rejected items until approvals are obtained. Resubmit only those items that were previously rejected or missing.
- C. A contract will not be issued to the Contractor until he has submitted the required information. No partial submittal will be accepted. Organize submittals neatly and logically for each piece of irrigation equipment. After the submittal has been approved, substitutions will not be allowed except by written consent of the Landscape Architect.

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- D. Submit specified shop drawings with dimensions, elevations, construction details, arrangements and capacity of equipment, as well as manufacturer's installation recommendations.

### 1.4 RULES AND REGULATIONS

- A. Provide work and materials in accordance with latest edition of International Electric Code, local and International Plumbing Codes, and applicable laws, regulations and codes of governing authorities.
- B. When contract documents call for materials or construction of better quality or larger size than required by above-mentioned rules and regulations, provide quality and size required by contract documents.
- C. If quantities are furnished either in specifications or on drawings, quantities are furnished for information only. It is Contractor's responsibility to determine actual quantities of material, equipment, and supplies required by the project and to complete independent estimate of quantities and wastage.
- D. Notify Landscape Architect in writing prior to construction about discrepancies between contract documents and existing site conditions or manufacturer's specific recommendations for use of their product.
- E. Contractor is responsible for damage to buildings, structures, and existing site amenities during construction. Replace damaged items with identical materials of equal value to match existing conditions. Make replacements at no additional cost to contract price.

### 1.5 TESTING

- A. Schedule testing with City of Sparks Representative a minimum of three (3) days in advance of testing.
- B. Mainline pipe jointed with rubber gaskets or threaded connections may be subjected to pressure test at any time after partial completion of backfill. Allow irrigation pipe jointed with solvent-welded PVC joints to cure at least 24-hours before testing.
- C. Subsections of mainline pipe may be tested independently, subject to review of Landscape Architect or City of Sparks Representative.
- D. Provide clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.
- E. Hydrostatic Pressure Test:
  - 1. Hydrostatic pressure test to be conducted for 2.5-inch and smaller mainline pipe.
  - 2. Subject mainline pipe to hydrostatic pressure equal to 140 PSI for two hours. Test with mainline components installed.
  - 3. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
  - 4. Purge air from mainline pipe before test. Attach pressure gauge to mainline pipe in test section.
  - 5. Observe pressure loss on pressure gauge. If pressure loss is greater than 5 PSI, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pressure loss is equal to or less than 5 PSI.



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6. Visually inspect irrigation pipe for leakage and replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pipe passes test.
7. Cement or caulking to seal leaks is prohibited.

### F. Operational Test:

1. Activate each remote control valve in sequence from controller using handheld remote. Manually activating remote control valve using manual bleed mechanism at remote control valve is not an acceptable method of activation. City of Sparks Representative will visually observe operation, water application patterns, and leakage.
2. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.
3. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
4. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
  - a. Repeat tests until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to Owner.

### G. Control System Acceptance Test:

1. Upon completion of construction, City of Sparks Representatives will administer a Control System Acceptance Test, including confirmation that on-site satellite controllers effectively communicate with City of Sparks Central Control System.
2. Following construction completion and review by City of Sparks Representative, an evaluation period will begin. After 30 days of continuous service without major system problems, system will be accepted and guarantee/warranty period will begin. If at any time during 30-day evaluation period a major system problem occurs, the source of problem will be determined and corrected and 30-day evaluation period will start again. Equipment will not be accepted until System Acceptance Test is passed.
3. If successful completion of Control System Acceptance Test is not attained within 90-days following commencement of evaluation period, City of Sparks Representative has the option to request replacement of equipment, terminate the order or portions thereof, or continue with Control System Acceptance Test. These options will remain in effect until Control System Acceptance Test is successfully completed.
4. Final payment will be made after successful completion of System Acceptance Test.

### H. Sensor Cable:

1. Test for leaks to ground per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
2. Test cable for continuity if cable is being installed for future expansion of the irrigation system.

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3. Replace defective wire, underground splices, or appurtenances. Repeat test until manufacturer's guidelines are met.
- I. Control System Grounding:
1. Test for proper grounding of control system and each controller assembly per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
    - a. Replace defective wire, grounding rods, grounding plates, or appurtenances. Repeat test until manufacturer's guidelines are met.
- J. Tracing Wire Test:
1. Pass current through wire and demonstrate that wire is capable of locating the pipe.
  2. If wire will not pass current, locate break and test until tracing wire works in accordance with its intended use.
- K. Testing Review:
1. Failure of initial testing reviews will require additional review. Payment of costs, including travel expenses and site visits, for additional reviews that may be required due to non-compliance with the Construction Documents will be Contractor's responsibility.

### 1.6 CONSTRUCTION REVIEW:

- A. The purpose of on-site reviews by Landscape Architect and City of Sparks Representative is to periodically observe work in progress, Contractor's interpretation of construction documents, and to address questions with regard to installation.
- B. Schedule reviews for irrigation system layout or testing with City of Sparks Representative as required by these specifications.
- C. Impromptu reviews may occur at any time during project.
- D. A review will occur at completion of irrigation system installation and Project Record Drawing submittal.

### 1.7 GUARANTEE/WARRANTY AND REPLACEMENT:

- A. The purpose of guarantee/warranty is to ensure that Owner receives irrigation materials of prime quality, installed and maintained in thorough and careful manner.
- B. Guarantee/warranty irrigation materials, equipment, and workmanship against defects for period of one year from formal written acceptance by City of Sparks Representative. Fill and repair depressions. Restore landscape, utilities, structures and site features damaged by settlement of irrigation trenches or excavations. Repair damage to premises caused by defective items. Make repairs within seven days of notification from City of Sparks Representative.
- C. Replace damaged items with identical materials and methods per contract documents or applicable codes. Make replacements at no additional cost to contract price.

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- D. Guarantee/warranty applies to originally installed materials and equipment, and replacements made during guarantee/warranty period.

### PART 2 - MATERIALS

#### 2.1 MATERIAL QUALITY:

- A. Use new materials without flaws or defects.

#### 2.2 SUBSTITUTIONS:

- A. Use specified equipment, or pre-approved equal. Alternative equipment must be approved by Landscape Architect and City of Sparks Representative prior to bidding. Changes and associated design costs to accommodate alternative equipment are Contractor's responsibility.
- B. Pipe sizes referenced in the construction documents are minimum sizes and may be increased at Contractor's option.

#### 2.3 SLEEVING:

- A. Provide sleeve beneath hardscape for irrigation pipe. Provide separate sleeve beneath hardscape for wiring bundle.
- B. Provide PVC pipe as presented on plans.
- C. Sleeve sizing: A minimum of twice the nominal diameter of solvent-welded pipe or wiring bundle, or as indicated on drawings. Sleeve diameter for gasketed pipe must accommodate outside diameter of joint-restraint casing spacers, refer to joint-restraint manufacturer's sizing recommendations.

#### 2.4 PIPE AND FITTINGS

- A. Mainline Pipe and Fittings:
  - 1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end.
  - 2. For pipe 2.5-inch and smaller; use Schedule 40 conforming to dimensions and tolerances established by ASTM Standard D1785.
  - 3. Use ductile iron service saddles with double stainless-steel straps for mainline connections to remote control valves and quick coupling valves; Smith-Blair Model 317 or approved equal.
  - 4. Use solvent weld pipe for mainline pipe with nominal diameter less than 3-inches. Use Schedule 80, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by pipe manufacturer. Use solvent cement conforming to ASTM Standard D2564.
  - 5. All PVC pipe shall bear the following markings
    - a. Manufacturer's name

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- b. Nominal pipe size
  - c. Schedule or class
  - d. Pressure rating in psi
  - e. National Sanitation Foundation (NSF) approval.
  - f. Date of extrusion
6. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.
  7. Mainline pipe within sleeves: Use solvent weld pipe for mainline pipe with nominal diameter 3-inches and smaller installed within sleeves.
- B. Lateral Pipe and Fittings:
1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end suitable for solvent welding.
  2. Use Schedule 40 conforming to dimensions and tolerances established by ASTM Standard D1785.
  3. Use solvent weld pipe for lateral pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.
- C. Specialized Pipe and Fittings:
1. Steel Pipe and Fittings: Use Schedule 40 steel pipe and fittings with Class 150 flanges.
  2. Use stainless steel fasteners and rubber gaskets for flanged connections. Use PVC Schedule 80 nipples and PVC Schedule 40 or 80 threaded fittings for threaded pipe connections.
  3. Joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by pipe fitting or valve manufacturer.

### 2.5 COPPER TRACING WIRE

- A. Use American Wire Gauge (AWG) No. 12-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial.
- B. Color: Tracing wire must be of color different from that of any active low voltage cable, control wire, or common wire. Wire color shall be continuous over entire length.
- C. Splices: Use Northstar Suresplice SK 14-12G or equal wire splices with wire nuts.

### 2.6 MAINLINE COMPONENTS

- A. Master Valve Assembly: as presented in drawings and installation details.

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- B. Flow Sensor Assembly: as presented in drawings and installation details.
- C. Isolation Gate Valve Assembly: as presented in drawings and installation details
- D. Quick Coupling Valve Assembly: as presented in drawings and installation details.
- E. Air-Vacuum Relief Valve Assembly: as presented in drawings and installation details.

### 2.7 DRIP IRRIGATION COMPONENTS

- A. Remote Control Valve (RCV) Assembly for Drip Laterals: as presented in drawings and installation details.
- B. Drip Emitter Assembly for Tree Applications:
  - 1. Install deep root watering canisters for trees as indicated on drawings.
  - 2. Flush Valve Assembly: as presented in drawings and installation details.
- C. Drip Emitter Assembly for Non-Tree (Shrub) Applications:
  - 1. Install single outlet emitters for groundcover, shrubs and trees as indicated on drawings.
  - 2. Install quantity of emitters as noted on drawings and details.
  - 3. Flush Valve Assembly: as presented in drawings and installation details.

### 2.8 CONTROL SYSTEM COMPONENTS

- A. Irrigation Controller Assembly:
  - 1. Install new irrigation controller as specified on the drawings and installation details.
  - 2. Lightning protection: As presented in drawings and installation details.
  - 3. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
- B. Irrigation Controller Assembly Enclosure:
  - 1. As presented conceptually in installation details.
  - 2. Constructed of stainless steel with free-flow ventilation.
- C. Power Wire:
  - 1. Use AWG #12, solid or stranded copper, Type UF single-conductor cable or multi-conductor with ground cable, UL approved for direct underground burial from power source to Controller Assembly.
  - 2. Splices: Use 3M #82-A2 Series with Split Bolts or Butt Connectors for inline splices and 82-B1 or 90-B1 Series for wye splices.

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3. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

### D. Communication Cable and Sensor Cable:

1. Sensor Cable: Use #14-1 AWG solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial, as recommended by central control system manufacturer and as indicated in the drawings.
2. Splices: Use 3M NevadaIC with 3M "Insulation Displacement Connectors" (316IR or UR-2), Ranger Serviseal Connectors, or approved equal, as recommended by central control system manufacturer.
3. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D-1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

### E. Low Voltage Control Wire:

1. Use American Wire Gauge (AWG) No. 14-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial for individual control wires and spare control wires from the controller assembly to each remote control valve or stub-out location.
2. Use American Wire Gauge (AWG) No. 12-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial for common ground wire and spare common wires from controller assembly to each remote control valve or stub-out location.
3. Color: Use white for common ground wire. Use easily distinguished colors for other control wires. Wire color shall be continuous over entire length. Install low voltage wires using the following color coding: Controller "A" control wires: Blue
  - a. Controller "A" common wire: White with blue stripe
  - b. Spare control wires along wire routing from each controller: Yellow with stripe matching control wire color
  - c. Spare common wires along wire routing from each controller: White with yellow stripe
4. Splices: Use Northstar Suresplice SK 14-12G wire splices with wire nuts (or approved equal).

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5. Electrical conduit: Use PVC Schedule 40 conduit conforming to dimensions and tolerances established by ASTM Standard D1785. Use Schedule 40, Type 1, PVC solvent weld sweep fittings for PVC conduit conforming to ASTM Standards D2466 and D1784 for buried installations. Use rigid metallic conduit with sweep elbows for above grade installations.
6. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

### 2.9 OTHER COMPONENTS

- A. Tools and Spare Parts: Furnish operating keys, servicing tools, test equipment, spare parts and other items indicated in drawings and specifications.
- B. Other Materials: Provide other materials or equipment shown on drawings or installation details that are part of irrigation system, even though items may not have been referenced in specifications.

## PART 3 - EXECUTION

### 3.1 INSPECTIONS AND REVIEWS:

- A. Site Inspections:
  1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities in writing to City of Sparks Representative prior to beginning work.
  2. Commencement of work implies acceptance of existing site conditions.
- B. Utility Locates ("Call Before You Dig"):
  1. Arrange and coordinate Utility Locates with local authorities prior to construction.
  2. Repair underground utilities that are damaged during construction. Make repairs at no additional cost to contract price.

### 3.2 LAYOUT OF WORK:

- A. Stake out irrigation system prior to installation. Items staked include: sprinklers, pipe, sleeves, control valves, air/vacuum relief valves, controller assemblies, and isolation valves.
- B. Irrigation System Layout Review: Irrigation system layout review will occur after staking has been completed. Notify City of Sparks Representative one week in advance of review. Modifications will be identified by City of Sparks Representative at this review.
- C. Install irrigation components inside of project property lines.

### 3.3 EXCAVATION, TRENCHING, AND BACKFILLING:

- A. Excavate and install pipes at minimum cover indicated in drawings or specifications. Excavate trenches at appropriate width for connections and fittings.
- B. Minimum cover (distance from top of pipe or control wire to finish grade):

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1. Mainline pipe, 4-inch and smaller: 24-inches to top of pipe.
  2. Electrical conduit: 24-inches to top of pipe.
  3. Control wire: 2-inches offset from bottom of mainline pipe.
  4. Tracing wire: Install along top of mainline pipe.
  5. Lateral pipe: 24-inches to top of pipe.
- C. Maintain at least 15-foot clearance from centerline of trees.
- D. PVC lateral pipe must be installed in open trench. Pipe pulling is not allowed. Install pipe at burial depths listed above.
- E. Backfill only after lines have been reviewed and tested.
- F. Excavated material is generally satisfactory for backfill. Use backfill free from rubbish, vegetable matter, and stones larger than 3/8-inch in maximum diameter. Remove material not suitable for backfill. Use backfill free of sharp objects next to pipe.
- G. Backfill trench by depositing backfill material equally on both sides of pipe in 6-inch layers and compacting to density of surrounding soil.
- H. Install pipe and wiring beneath roadways and hardscapes within separate sleeves. Minimum compaction of backfill for sleeves shall be 95 percent Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.
- I. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
- J. Contact City of Sparks Representative for trench depth adjustments where utilities conflict with irrigation trenching and pipe work.

### 3.4 SLEEVING AND BORING:

- A. Provide sleeving at depth that permits encased pipe or wiring to remain at specified burial depth.
- B. Extend sleeve ends twelve inches beyond edge of hardscape. Cap sleeve ends and mark with stakes. Provide rope or wire through sleeve and secure to stake at surface grade at each end for future sleeve location.
- C. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

### 3.5 ASSEMBLING PIPE AND FITTINGS:

- A. General:
  1. Keep pipe free from dirt and debris. Cut pipe ends square, debur and clean as recommended by manufacturer.
  2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.



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3. Trenches may be curved to change direction or avoid obstructions within limits of the curvature of pipe. Curvature results from bending of pipe lengths. Do not exceed pipe and fitting manufacturer’s allowable deflection at joints. Minimum radius of curvature and offset per 20-foot length of pipe-by-pipe size are shown in following table.

SIZE	RADIUS	OFFSET PER 20' LENGTH
1 ½"	25'	7'-8"
2"	25'	7'8"
2 ½"	100'	1'-11"
3"	100'	1'-11"

**B. Mainline Pipe and Fittings:**

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. SCH.40 PVC Solvent Weld Pipe for Mainlines 3” and Smaller:
  - a. Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
  - b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
  - c. Snake pipe from side to side within trench.
3. Fittings:
  - a. Use of cross type fittings is not permitted.

**C. Lateral Pipe and Fittings:**

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Solvent Weld Pipe:
  - a. Use primer and solvent cement. Join pipe in manner recommended by manufacturer and in accordance with accepted industry practices.
  - b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
  - c. Snake pipe from side to side within trench.
3. Fittings: Use of cross type fittings is not permitted.

**D. Specialized Pipe and Fittings:**

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1. Steel Pipe: Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
2. Flanged connections: Install fittings, fasteners and gaskets in manner recommended by manufacturer and in accordance with accepted industry practices
3. PVC Threaded Connections:
  - a. Use only factory-formed threads. Field-cut threads are not permitted.
  - b. Apply thread sealant in manner recommended by component, pipe and sealant manufacturers and in accordance with accepted industry practices.
  - c. Use plastic components with male threads and metal components with female threads where connection is plastic-to-metal.

### 3.6 INSTALLATION OF MAINLINE COMPONENTS:

- A. Master Valve Assembly: Provide where indicated on drawings. Brand "MCV" on valve box lid in 2-inch high letters.
- B. Flow Sensor Assembly: Provide where indicated on drawings. Brand "FS" on valve box lid in 2-inch high letters.
- C. Isolation Gate Valve Assembly: Provide where indicated on drawings. Install at least 12- inches from and align with adjacent walls or edges of paved areas. Brand "GV" on valve box lid in 2-inch high letters.
- D. Quick Coupling Valve Assembly: Provide where indicated on drawings. Brand "QC" on valve box lid in 2-inch high letters.
- E. Air-Vacuum Relief Valve Assembly: Install where indicated on drawings or nearest high point, not closer than 2-feet from nearest fitting. Brand "AV" on valve box lid in 2-inch high letters.

### 3.7 INSTALLATION OF DRIP IRRIGATION COMPONENTS:

- A. Remote Control Valve (RCV) Assembly for Drip Laterals:
  1. Flush mainline pipe until water runs clear without sediment or debris before installing RCV assembly.
  2. Locate as shown on drawings. Connect control wires to remote control valve wires using wire connectors and waterproof sealant. Provide connectors and sealant per manufacturer's recommendations.
  3. Provide only one RCV to valve box. Locate at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Align grouped valve boxes in uniform patterns. Allow at least 12-inches between valve boxes. Brand controller letter and station number on valve box lid in 2-inch high letters.
  4. Arrange grouped valve boxes in rectangular patterns.

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### B. Drip Emitter Assembly:

1. Locate as shown on drawings and installation details.
2. Flush lateral pipe until water runs clear without sediment or debris before installing emitter assembly.
3. Cut emitter outlet distribution tubing square.
4. Use tools manufactured, and techniques recommended, by emitter manufacturer.

C. Flush Valve Assembly: Provide at end of each drip irrigation lateral pipe as shown and directed on drawings and installation details. Install at least 12-inches from and align with adjacent walls or edges of paved areas. Brand "FV" on valve box lid in 2-inch high letters.

### 3.8 INSTALLATION OF CONTROL SYSTEM COMPONENTS:

#### A. Irrigation Controller

1. Location of controller assemblies as depicted on drawings. Install controller assembly and enclosure in accordance with controller manufacturer recommendations.
2. Lightning protection: As shown on drawings and installation details.
3. Coordinate and provide installation of electrical service in accordance with local codes. Provide primary surge protection arrestors on incoming power lines in accordance with controller manufacturer recommendations.
4. Connect control wires to corresponding controller terminal. Attach wire markers to ends of control wires inside controller assembly housing. Label wires with identification number (see drawings) of remote control valve to which control wire is connected.

#### B. Power Wire:

1. Route power wire as directed on plans. Install with minimum number of field splices. If power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in jumbo rectangular valve box. Coil 3- feet of wire in valve box.
2. Install power wire within conduit using open trenches. Use of a vibratory plow is not permitted.
3. Use green wire as common ground wire from power source to controller assembly.
4. Carefully backfill around conduit for power wire to avoid damage to wire insulation or wire connectors.
5. Install wire parallel with and below mainline pipe unless noted otherwise on plans. Install wire at depth required by local codes.
6. Provide continuous run of warning tape above power wire. Install warning tape six inches above wire. Encase power wire within electrical conduit where not installed in common trench with PVC mainline pipe.

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### C. Communication Cable and Sensor Cable:

1. Route cable as directed on plans. Install with minimum number of field splices.
2. Install cable using open trenches and install in conduit. Use of vibratory plow is not permitted.
3. Carefully backfill around cable to avoid damage to wire insulation or wire connectors.
4. If cable must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in housing afforded by other control system components or separate 12-inch standard valve box. Coil 3-feet of cable in valve box.
5. Install cable parallel with and below mainline pipe unless noted otherwise on plans.
6. Provide continuous run of warning tape above cable. Install warning tape six inches above cable. Encase cable within electrical conduit where not installed in common trench with PVC mainline pipe.

### D. Low Voltage Control Wire:

1. Bundle control wires where two or more are in same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals. Do not tape wires together where contained within sleeving or conduit.
2. Provide 24-inch excess length of wire in 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tape or tie wiring loop. Coil 30-inch length of wire within each remote control valve box.
3. Install common ground wire and one control wire for each remote control valve. Multiple valves on single control wire are not permitted.
4. If control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per manufacturer's instructions. Locate splice in valve box that contains irrigation valve assembly, or in separate standard rectangular valve box. Use same procedure for connection to valves as for in-line splices.
5. Install wire parallel with and offset from mainline pipe unless noted otherwise on plans.
6. Install cable using open trenches. Use of vibratory plow is not permitted.
7. Encase wiring within electrical conduit where installed above grade.
8. Protect wire not installed with PVC mainline pipe with continuous run of warning tape placed in backfill six inches above wiring.

## 3.9 INSTALLATION OF OTHER COMPONENTS:

- A. Tools and Spare Parts: Prior to Review at completion of construction, supply to Owner operating keys, servicing tools, spare parts, test equipment, and other items indicated in General Notes on the drawings.
- B. Other Materials: Provide other materials or equipment shown on drawings or installation details that are part of irrigation system, even though items may not have been referenced in specifications.

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### 3.10 PROJECT RECORD (AS-BUILT) DRAWINGS:

- A. Document changes to design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until accurate "as-built" information is recorded.
- B. Record pipe and wiring network alterations on a daily basis. Record work that is installed differently than shown on construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each controller assembly, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within valve box.
- C. Obtain from City of Sparks Representative a reproducible copy of drawings prior to construction completion. Duplicate information contained on project drawings maintained on-site using technical drafting pen or CAD. Label each sheet "Record Drawing".
- D. Turn over "Record Drawings" to City of Sparks Representative. Completion of Record Drawings is required prior to final construction review at completion of irrigation system installation.

### 3.11 CONTROLLER CHARTS

- A. Do not prepare charts until record drawings have been approved by the City of Sparks Representative.
- B. Provide two controller charts per controller.
- C. Chart may be a reproduction of the Record Drawing, if the scale permits fitting the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility. Coordinate with staff.
- D. Chart shall be black line print of the actual system, showing the area covered by that controller.
- E. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage.
- F. Following approval of charts by the City of Sparks Representative, they shall be hermetically sealed between two layers of 20 mil thick plastic sheet.
- G. Charts must be completed and approved prior to final acceptance of the irrigation system.
- H. The Owner reserves the right to have complete access to the controller clocks for monitoring and controlling system failures. The contractor shall provide the Owner with two sets of all keys necessary for access to the controller clocks within the design area. The keys will then become the property of the Owner.

### 3.12 OPERATING AND MAINTENANCE MANUALS, EQUIPMENT TRAINING

- A. Provide three individually bound manuals detailing operating and maintenance requirements for irrigation systems.
- B. Manuals shall be delivered to the City of Sparks Representative no later than 10 days prior to acceptance of work and the start of the maintenance period. Project acceptance will not occur and the start of the maintenance period will not occur until the operating and maintenance manuals and

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equipment training has occurred.

- C. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate and maintain the equipment.
- D. Provide the following in each manual:
  - 1. Index sheet, stating Irrigation Contractor's name, address, telephone number and name of person to contact.
  - 2. Duration of guarantee period.
  - 3. Equipment list providing the following for each item:
    - a. Manufacturer's name
    - b. Make and model number
    - c. Name and address of local manufacturer's representative
    - d. Spare parts list in detail
    - e. Detailed operating and maintenance instructions of major equipment.
  - 4. Sources of parts for each piece of equipment provided on the project.
- E. Provide the City of Sparks maintenance personnel with training for operation of all major equipment and provide written evidence to the Owner, at the conclusion of the work, that the training took place. Provide a minimum of four training sessions for the Owner to utilize over a year following the conclusion of the maintenance and warranty period. Such training shall be furnished to the Owner by authorized personal from the contractor at no additional cost to the owner.

### 3.13 MAINTENANCE:

- A. Maintain irrigation system for a duration of 90 calendar days from formal written acceptance by City of Sparks Representative. Make periodic examinations and adjustments to irrigation system components in order to achieve the most desirable application of water.
- B. Following completion of Contractor's maintenance period, Owner will be responsible for maintaining system in working order during remainder of guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after landscape maintenance operation.

### 3.14 CLEANUP:

- A. Remove from site machinery, tools, excess materials, and rubbish upon completion of work.

**END OF SECTION 32 8400**

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**SECTION 32 9000  
PLANTS AND PLANTING**

**PART 1 - GENERAL**

**1.1 SCOPE:**

- A. Furnish labor, materials, and equipment to complete the work of planting tree, shrubs and groundcovers as shown on the drawings and as specified.

**1.2 QUALITY ASSURANCE**

- A. Comply with federal, state, and local laws requiring inspection for plant disease and infestations. Inspection certificates required by state law shall accompany each shipment of plants and deliver certificates to the owner. Inspections are to be performed in the state of origin.
- B. Transport plant materials in enclosed or tarped vehicles to minimize damage from wind and sun. Owner's Representative is to carefully inspect all plant material at the site at the time of off-loading trucks to verify compliance with the above shipping requirements.
- C. Substitutions of plant materials will not be permitted unless authorized in writing by the Owner's Representative.
- D. Personnel: Employ only qualified personnel familiar with required work.
- E. Nursery: Company specializing in growing and cultivating the plants specified in this Section with minimum three years documented experience.
- F. Installer: Nevada Licensed Contractor specializing in installing and planting the plants specified in this section.

**1.3 REFERENCES, STANDARDS AND COORDINATION**

- A. "American Standard for Nursery Stock"; Edition approved 1985 by American National Standards Institute, Inc. (Z60.1)--plant materials.
- B. "Hortus Third", 1976; Cornell University--plant nomenclature.
- C. Arizona Nursery Association Grower's Committee "Recommended Tree Specifications", 1988, Arizona Nursery Association.
- D. Truckee Meadows Water Authority Plant Guide.

**1.4 SUBMITTALS**

- A. File Certificates of Inspection of plant materials by County, State and Federal authorities if required. All plants are to have a Certificate of Origin.
- B. Refer to Section 01 3300 for Submittal REquirements. Owner reserves the right to approve or reject suppliers and subcontractors.

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- C. Submit instructions for continuing Owner maintenance under provisions of general Conditions Section 4.0.

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

#### A. Preparation

- 1. Contractor is to spray evergreen plants and deciduous plants in full leaf with anti-desiccant immediately prior to shipment.

#### B. Delivery

- 1. Deliver packaged material in sealed waterproof bags or containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- 2. Deliver only plant materials that can be planted in one day unless adequate storage and watering facilities are available on project site.
- 3. Notify the Owner's Representative of delivery schedule a minimum of 48 hours in advance so plant material can be inspected.
- 4. Remove rejected materials immediately from site.
- 5. Do not lift, move, or otherwise manipulate plants by trunk or stems.

### 1.6 JOB CONDITIONS

#### A. Planting Restrictions

- 1. Perform actual planting only when weather and soil conditions are suitable, in accordance with locally accepted practice.
- 2. Do not install plant life when ambient temperatures may drop to below 35 degrees F or above 105 degrees F.
- 3. Do not install plants when wind velocity exceeds 30 mph.

#### B. Protection

- 1. Do not move equipment over existing or newly placed structures without approval of the Owner's Representative.
- 2. Provide board covering as required to protect paving.
- 3. Protect other improvements from damage with protection boards, ramps and protective sheeting.

#### C. Utilities

- 1. Determine location of underground utilities and perform work in a manner, which will avoid possible damage. Hand excavate, if required, to minimize possibility of damage to underground utilities. Repair and replace immediately at Contractor's expense utilities, conduits, etc. that are



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damaged as a result of Contractor's work. Call before you dig.

2. Coordinate work with irrigation contractor to prevent damage to underground irrigation system.

### 1.7 WARRANTY

- A. Warranty plants for a one full year period after Certificate of Substantial Completion. Replace dead or dying materials not in a vigorous, thriving condition as soon as weather permits and on notification by the Owner's Representative. Replace plants, which in the opinion of the Owner's Representative have partially died, thereby damaging shape, size or symmetry. Newly replanted trees to be tagged with a waterproof tag with new warranty date (date of new installation).
- B. Replace plants with same kind and size as originally installed at no cost to owner. Remove dead or dying trees as directed by the Owner's Representative. Protect irrigation system and other planting during replacement operations.
- C. After pre-maintenance acceptance, warranty excludes Contractor responsibility for replacement of plants because of injury by storms and freezing. Plants and other materials damaged for any reason, other than negligence by Owner or his employees, prior to pre-maintenance acceptance are the responsibility of the Contractor.

### 1.8 MAINTENANCE SERVICE

- A. Maintain plant life immediately after placement until plants are well established and exhibit a vigorous growing condition for 90 days.
- B. Maintenance to include:
  1. Cultivation and weeding plant beds and tree pits.
  2. Application of herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
  3. Application of pesticides in accordance with manufacturer's instructions. Remedy damage from use of pesticides.
  4. Irrigating sufficient to saturate root system, adjust emitter locations to allow for improved watering. Add or delete emitters where needed.
  5. Trimming and pruning, including removal of clippings and dead or broken branches, and treatment of pruned areas or other wounds.
  6. Disease control.
  7. Maintain tree staking, repair or replace staking accessories when damaged.
  8. Fertilize all plants every 60-days with liquid fertilizer.
  9. Apply pre-emergent every 60-days, water activation is required.
  10. Cover and protect plant material from excessively cold temperatures.

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### PART 2 - MATERIALS

#### 2.1 PLANTS

- A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless specifically noted otherwise. Plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.
- B. Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs or larvae and shall have healthy, well-developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth. Soil in the containers shall be free of disease and pathogens.
- C. Plants shall be true to species and variety and shall conform to measurements specified, except that plants larger than specified may be used if approved by Owner's Representative. Use of such plants shall not increase Contract price. If larger plants are approved, the ball of earth shall be increased in proportion to the size of the plant. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on the trunk 6" above natural ground line for trees up to 4" in caliper and at a point 12" above the natural ground line for trees over 4" in caliper. If a range of size is given, no plant shall be less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread, shall be rejected.
- D. Container stock shall have grown in the containers in which delivered for at least six months, but not over two years. Samples must prove no root bound conditions exist. Container plants that have cracked or broken balls of earth when taken from container shall not be planted.
- E. Field dug plants may be used only if specifically approved in writing by the Owner's Representative prior to ordering. Unless otherwise authorized, field dug plants will be harvested with a two-step method, in which the four sides are cut and box sides installed for a minimum of four (4) months during the growth season prior to digging and boxing the bottom. Pray field dug trees immediately prior to boxing the bottom with anti-desiccant. Ensure adequate coverage to trunks, branches and foliage.
- F. Plants shall not be pruned before delivery. Trees, which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4" which have not completely callused will be rejected.
- G. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule grown in climatic conditions similar to those in locality of the Work. At least 10% of all plant varieties are to have nursery identification tags attached.

#### 2.2 DRAIN GRAVEL:

- A. 3/8-inch washed pea gravel.

#### 2.3 STAKING MATERIALS

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- A. Tree Stakes: All stakes are to be Lodge pole pine with 10-inch tapered driving point and chamfered top; treated with copper naphthanate to heartwood; green in color, 2 inches in diameter x 8 feet in length for 15 gallon trees and 2 inches in diameter x 10 feet in length for 24 inch and 30 inch box trees. If tree is staked, 24 inch of stake is to be driven into soil. Staking shall be by industry standards.
  - 1. All standard tree ties for staking shall be done with 1/2" Flexible PVC drip tube with #1-gauge wire screwed securely to lodge poles according to manufacturer's specifications.
  - 2. Multi-trunk trees to be staked with three-lodge pole pine stakes, length same as above, individual trunks are to be attached to the wood stakes with wire and flex hose. Wiring to be secured to poles with galvanized staples.
  - 3. Contractor to coordinate with Owner's Representative to choose which trees are standard and which are multi-trunked for approval.

### 2.4 ANTI-DESICCANT:

- A. Anti-desiccants for retarding excessive loss of plant moisture and inhibiting wilt shall be sprayable, water insoluble vinyl-vinylethylene complex which will produce a moisture retarding barrier not removable by water. Wilt-proof Formula NCF as manufactured by Nursery Specialty Products, Greenwich, Connecticut, or approved equal.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine subgrade and verify conditions under which work will be performed. Notify Owner's Representative if there is a discrepancy between site conditions and Contract Documents.
- B. Soil Preparation: Only native soils are to be used and mixed with the container soils the plants are delivered in.
- C. Irrigation: Do not commence planting work prior to installation and acceptance of irrigation system, unless approved in writing by Construction Manager.

### 3.2 PREPARATION

- A. Layout and Staking: Layout plants at locations shown on Drawings. Use steel wired flags, color-coded for each species of plants. Stake each tree. Place shrubs in position on bed areas before cans have been removed.
- B. Review: Locations of plants will be checked in the field by the Owner's Representative and will be adjusted to exact position before planting begins. Right is reserved to refuse review at this time if, in the opinion of the Owner's Representative, an insufficient quantity of plants is not available. Owner's Representative reserves the right to interchange or adjust the locations of plants prior to planting.
- C. Equipment for Digging Plant Pits: Use backhoe or handwork to dig tree pits. Scarify sides of the tree pit after excavation. Do not use an auger or tree spade.
- D. Containerized Plant Pits: Excavate square plant pits as shown in the planting details. Remove excavated soil from project site and use for backfill.

**3.3 DRAINAGE TEST OF PLANT PITS/OBSTRUCTIONS**

- A. Pre-wetting of tree plant pits: Fill tree plant pits to the top with water within 72 hours of planting. Plant pits can be planted as soon as water is completely drained. If water is not 90% gone within 24 hours, do not plant and bring to the immediate attention of the Owner's Representative. Contractor may be required to either dig a substitute plant pit or to mitigate the existing pit with a drainage sump or chimney drain.
- B. Documentation: Submit written documentation of test pit drainage results, with locations, date and signature of tester.
- C. Obstructions: If rock, caliche, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits, acceptable alternate locations may be used as directed by the Owner's Representative.

**3.4 PLANTING OPERATIONS - TREES AND SHRUBS**

- A. Handling and De-Potting:
  - 1. Moisture Level: Thoroughly moisten rootballs prior to planting to ensure soil cohesiveness; do not plant dry rootballs.
  - 2. Carefully remove plant from the container. Cut tin containers, other than knockout cans, on two sides with the proper type of can cutter to facilitate removal of plants with a minimum of rootball disturbance. Support rootball during installation to prevent cracking.
  - 3. Pry off bottom boards of boxed trees rather than hammering boards off. Boxed plants may not be planted with the bottom or sides of the box in place.
- B. Scarification:
  - 1. Plant Pit: Scarify sides of plant pit thoroughly breaking up surface and eliminating "glazed" areas.
  - 2. Plant Rootball: After removing plant from container, scarify the sides of the rootball to a depth of 1 inch at four to six equally space intervals around the perimeter of the ball or at 12-inch intervals on the sides of boxed material. Cut and remove circling roots over 3/8-inch diameter. Scarification should be performed with a sharp soil knife.
- C. Positioning:
  - 1. Backfill plant pit to allow crown of rootball to settle to a position even with finished grade. Thoroughly tamp backfill under rootball to reduce settling, and on sides of rootball after plumbing plant.
  - 2. Place fertilizer paks evenly in plant pits when backfilled 2/3 full.
  - 3. When plant pits have been backfilled approximately 2/3 full, water thoroughly and saturate rootball, before installing remainder of the backfill mix to top of pit, eliminating air pockets.
  - 4. Remove nursery type plant labels from plants just prior to substantial completion.

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5. Watering Basin: Form saucer with 4 inches high by 6 inches wide berm centered around tree and shrub pit 12 inches wider than rootball diameter. Do not form saucer around tree in lawn areas.
6. Place plants for best appearance for review and final orientation by the Owner's Representative.

### D. Backfilling:

1. Only native soils are to be used and mixed with the container soils the plants are delivered in.

### 3.5 INSTALLATION OF ACCESSORIES

- A. A non-selective pre-emergent appropriate for the season shall be applied to all shrub beds as per manufacturer's recommendations. Avoid application to any areas to be seeded. Acceptable products are: Ronstar, Devinol WP40 and Treflan or approved equal.
- B. Decomposed granite/crushed rock. Granite mulch shall not be placed until the required water distribution systems and planting operations have been completed within the area.
- C. The surfaces upon which decomposed granite or crushed rock mulch is to be placed shall be graded and compacted to a density of 85 to 90 percent of the maximum density. The Owner's Representative will designate areas that shall not be compacted. The areas on which mulch is to be placed shall be reasonably smooth and firm and all deleterious material. Rocks larger than 1 inch in diameter shall be removed and disposed of by the contractor.
- D. Decomposed granite or crushed rock mulch shall be evenly distributed over the designated areas. The depth of the decomposed granite or granite mulch shall be at least the minimum depth shown on the project plans. All areas to receive mulch shall be as approved by the Owner's Representative prior to placement of the mulch.
- E. The contractor shall apply two applications of an approved pre-emergent herbicide on all mulch areas, one before and one following placement of the mulch.
- F. The contractor shall notify the Owner's Representative and obtain prior approval for the use of any herbicides for weed eradication. He shall keep a record of all applications; and the date and location of such applications. A copy of this record shall be submitted to the Owner's Representative.
- G. After placing, spreading and grading the mulch, the contractor shall water settle the total thickness of the mulch, removing the fine material from the surface.
- H. All erosion or damage that occurs within the rock mulch areas shall be corrected during the maintenance period.
- I. Contractor is to make one additional pre-emergent application one week prior to substantial completion. It is the Contractor's responsibility to select the correct pre-emergent for the season being applied.

### 3.6 PREMAINTENANCE INSPECTION

- A. At the time of Pre-maintenance Inspection, the Contractor shall have planting areas under this Contract free of weeds and neatly cultivated. All tree stakes shall be plumb and tight, ties securely fastened, etc.
- B. No partial approvals will be given, unless authorized in writing by the Owner's Representative.

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**3.7 CLEANUP:**

- A. Keep areas of work clean, neat and orderly. Keep areas clean during planting and maintenance operations. Clean up and remove deleterious materials and debris from the entire work area prior to beginning of landscape maintenance period to the satisfaction of Owner's Representative.

**3.8 PLANT ESTABLISHMENT WORK:**

- A. Pursuant to the Uniform Standard Specifications.

**END OF SECTION 32 9000**

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**SECTION 32 9119  
LANDSCAPE GRADING**

**PART 1- GENERAL**

**1.1 SCOPE**

- A. Furnish labor, materials, and equipment for grading and construction work shown on the drawings and specified.

**1.2 RELATED SECTIONS**

- A. Section 32 84 00 – Landscape Irrigation
- B. Section 32 90 00 – Plants and Planting

**1.3 SUBMITTALS**

- A. Samples: Submit a one-half cubic foot sample of proposed off-site borrow fill from each source for Owner's Representative's review and approval; identify location and source.
- B. Test Reports required:
  - 1. Select Fill: Liquid limit and plasticity index.
  - 2. Imported Topsoil: Physical and chemical analysis.
- C. Native Soil: Physical and chemical analysis.

**1.4 REFERENCES AND STANDARDS**

- A. Work shall comply with the rules and regulations of local, state and federal agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary to such rules, regulations and codes.
- B. ASTM Standards.

**1.5 TESTING**

- A. Where reference is made to relative compaction, it shall be the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, determined by the ASTM D1557 laboratory test procedures. Optimum moisture is the water content that corresponds to the maximum dry density.

**1.6 PROJECT CONDITIONS**

- A. Existing Conditions: The existing topographic conditions are shown on the drawings for reference only. Upon beginning the earthwork, Contractor represents that he has inspected the site and satisfied himself as to actual grades and levels and the true conditions under which the work is to be performed. Promptly notify the Owner's Representative of unexpected subsurface conditions.
- B. Protection

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1. Protect excavations by shoring, bracing, sheeting, underpinning, or other methods, as required to prevent cave-ins or loose dirt from entering excavations. Barricade open excavations and post warning lights at work adjacent to public streets and walks.
  - a. Cover holes and trenches when work is not in progress. Fence or barricade changes of plane more than 45 degrees horizontally and more than 3 feet vertically.
  - b. Maintain benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
  - c. Protect existing berms and slopes from disruption. If slopes are disturbed, return to existing conditions at no additional cost to the Owner.
  - d. Underpin adjacent structure(s), including utility service lines, which may be damaged by excavation operations.
  - e. Protect existing natural areas and landscape improvements from damage.
  - f. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repair at Contractor's expense.
  - g. Soil Classification: Excavated materials are not classified as to type. Excavation includes rubble and debris.

### C. Dust Control

1. Dampen the area of grading and take other measures as required to prevent rising of dust and transportation of it into buildings and onto adjacent properties for the duration of the Contract in accordance with Pershing County codes and regulations.
2. Comply with the NDEP Air Quality Operating Permit.

## PART 2 - MATERIALS

### 2.1 SOILS

- A. On-Site Borrow Fill: Utilize on-site borrow material from grading operations for landscape mound construction to the extent possible. Material shall be inspected, tested, and a laboratory report issued and general filling prior to use in work, if it is deemed necessary by the owner.
  1. Backfill and or Mounding: Contractor is required to process fill material to remove all rocks, etc. over 1 1/2 inches diameter prior to placement. No rocks larger than 1-1/2 inches diameter are allowed a mounded area.
    - a. Remove and dispose of rocks removed during soil processing at an appropriate off-site disposal area.
- B. Off-Site Borrow Fill for Use Under Paving and Structures
  1. For soil under slab and aggregate, utilize off-site fill material or process on-site material to the following specifications. Gradation (ASTM C136), percent passing by weight:



## City of Sparks - Fire Station #6

- a. 3" Sieve: 100%
  - b. No. 4 Sieve: 25-75%
  - c. No. 200 Sieve: 20% (Max)
- C. For 6 inches immediately beneath slabs-on-grade, utilize Type II Aggregate Base, per U.S.S. 704.03.04
- D. 1/16 inch Minus Topsoil: Provide off-site 1/8 inch minus topsoil or process on-site fill material for groundcover areas and plant backfill mix. See Section 32 90 00 for amendments that may need to be added prior to placement. 1/16" minus topsoil to have the following specifications:
1. Organic Matter: 0.1 to 1.0% by dry weight of soil
  2. Particle Size: 1/16 inch (3.18 centimeter) maximum
  3. Clay and Silt Content: 8% maximum (by weight)
  4. pH Factor: 7.0 to 8.0
  5. Electrical Conductivity: Max. of 3.0 MMHOS. per centimeter of the saturation paste extract
  6. Salts : Less than 2.0 MMHOS/CM
  7. Boron: Less than 1.0 PPM
  8. Percolation Rate: Greater than 2 inches per hour

### 2.2 PLANTING SOIL FOR PLANT BACKFILL

- A. Only native soils are to be used and mixed with the container soils the plants are delivered in.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Establish extent of grading and excavation by area and elevation. Designate and identify datum elevation and project engineering reference points. Set required lines, levels and elevations.
- B. Do not cover or enclose work of this Section before obtaining required inspections, tests, approvals, and location recording.

### 3.2 EXISTING UTILITIES

- A. Before starting grading and excavation, establish the location and extent of underground utilities in the work area. Exercise care to protect existing utilities during earthwork operations. Perform excavation work near utilities by hand and provide necessary shoring, sheeting, and supports as the work progresses.
- B. Maintain, protect, relocate, or extend, as required, existing utility lines to remain which pass through the work area. Pay costs for this work, except as covered by the applicable utility companies.

## City of Sparks - Fire Station #6

- C. Protect active utility services uncovered by excavation. Notify respective utility companies of damage caused to active utilities immediately.
- D. Remove abandoned utility service lines from areas of excavation. Cap, plug, or seal abandoned lines and identify termination points at grade level with markers.
- E. Accurately locate and record abandoned and active utility lines rerouted or extended on project record documents.

### 3.3 SITE GRADING-GENERAL

- A. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles, and contours indicated. Provide uniform levels and slopes between new elevations and existing grades.
- B. Obtain approval of scarified subgrade surfaces by Owner's Representative prior to filling operations. Scarify, dry and compact soft and wet areas; remove and replace unsuitable subgrade materials with an approved fill material. Take corrective measures before placing fill materials.
- C. Thoroughly scarify in two separate directions existing soil surface to a depth of 5" and verify scarification with Owner's representative prior to placing fill material in mounded areas. Additional scarification will be required if not thoroughly scarified.
- D. Spread approved fill material uniformly in layers not greater than 8 inches of loose thickness over entire fill zones.
  - 1. Lift thickness requirements may be modified by Owner's Representative to suit equipment and materials or other conditions when required to assure satisfactory compaction.
  - 2. Place and compact each layer of fill to 85% maximum compaction before placing additional fill material. Repeat filling until proposed grade, profile or contour is attained.
  - 3. Suspend fill operations when satisfactory results cannot be obtained because of environmental or other unsatisfactory site conditions. Do not use muddy fill materials. Do not place fill material on muddy subgrade surface.
  - 4. Grade surfaces to assure positive drainage and to prevent ponding and pockets of surface drainage. Install drainage swales as indicated on the Drawings.
  - 5. Protect finish graded areas from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settled, eroded and damaged areas.
- E. If in the opinion of the Owner's surveyor and/or representative the completed site grading does not reflect the Contract Documents, an independent surveyor may be hired to verify the grades. If the grades are correct, the owner will pay for the survey. If the grades are incorrect, the cost of the survey will be deducted from the Contractor price.

### 3.4 BACKFILLING/FILLING FOR PAVING AND STRUCTURES

- A. NOT USED.

### 3.5 IMPORTED TOPSOIL PLACEMENT

#### Landscape Grading - 32 9119

Bid Set - Jan 04, 2024

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## City of Sparks - Fire Station #6

- A. Obtain Owner's Representative's approval of rough grading before placing of imported topsoil. Scarify subgrade, if over non-fill areas, and place-designated depth of imported topsoil in a uniform layer as indicated in the Contract Documents.
- B. Level imported topsoil to eliminate water pockets and maintain indicated cross slopes and drainage swales. Compact to 85% maximum Modified Proctor Density in planted areas.

### 3.6 FINISH GRADING

- A. Grade uniformly with rounded surfaces at tops and bottoms of abrupt changes in plane. Hand grade steep slopes, areas that are inaccessible for machine work and areas around existing plants.
- B. Slope graded surfaces to drain water away from structures, walls, etc.; minimum slope is 1/4 inch in 12 inches.
- C. Grade areas to elevation and slopes indicated without depressions causing pocketing of surface water or humps, producing localized runoff and gulying. Ponding of water on-site is not allowed. Finish surfaces to be not more than 0.10 foot above or below established grade elevation unless approved in writing by Owner's Representative.
  - 1. Planting beds 3 inches below all curb and sidewalks and 2 inches below structure (to allow for crushed rock). The depth will vary upon rock sizes and depths.
- D. The contractor is to review the proposed grades and the surface material being installed. Where needed the grades are to be adjusted to allow for the proper depth and clearance allowing a one-inch clear zone between the walk or curb and the proposed material as noted:
  - 1. Imported topsoil depths
  - 2. Rock Mulches (depths will vary upon rock sizes)
  - 3. Inorganic Mulches
  - 4. Other materials not listed here but noted in documents will require proper placement and installation.
- E. Top of fill: Plus or minus 2 inch from structure, sidewalks, curbs, etc. Subject to Owner's Representative's approval.

### 3.7 DRAINAGE

- A. Provide positive drainage of the working area at all times.

### 3.8 DISPOSAL OF WASTE MATERIALS

- A. Remove excess excavated materials, trash and debris from site and legally dispose.
- B. Maintain disposal route clear, clean and free of debris.

### 3.9 CLEANING

**City of Sparks - Fire Station #6**

- A. Upon completion of earthwork operation, clean areas within contract limits, remove tools and equipment. Clean adjacent street as directed by the Owner's Representative.
- B. Provide site clear, clean, free of debris and suitable for site work operations.

**END OF SECTION 32 9119**

# **Forms**

**(to be used following award of bid)**

- 1) Contract Form**
- 2) Performance Bond**
- 3) Payment Bond**

**TITLE**  
**BID # BIDNUMBER**  
**PWP# PWPNUMBER**

THIS CONTRACT made and entered into on this **DAY day of MONTH, YEAR** by and between the City of Sparks, Nevada, a municipal corporation, existing under and by virtue of the laws of the State of Nevada, hereinafter called "City", and **CONTRACTORNAME**, a qualified Contractor in the class of work required, hereinafter called "Contractor".

W I T N E S E T H

WHEREAS, the City has awarded a contract to Contractor for providing material and/or performing the work hereinafter mentioned in accordance with the proposal of said Contractor;

WHEREAS, the Contractor will provide the material and/or perform the work for the compensation stated in said proposal, an amount which has been arrived at between the parties;

WHEREAS, each party is willing to and does assume joint liability for the contents of this Contract, and each party accordingly agrees that it shall not be construed against any party as a drafting party;

NOW, THEREFORE, IT IS AGREED as follows:

**1. Scope of Work:**

The scope of work for this contract is generally defined as **TITLE**. The City's Contract Documents and Contractor's Entire Proposal are on file with the City of Sparks. All terms, conditions and requirements contained within these Documents, including any and all bid documents, addenda and specifications issued by the City, are hereby incorporated by reference into this Contract.

The Contractor shall perform within the time stipulated, the Contract as herein defined and shall provide and furnish any and all of the labor, materials, methods or processes, equipment implements, tools, machinery and equipment, and all utility, transportation and other services required to construct, install and put in complete order for use in a good and workmanlike manner all of the work covered by the Contract in connection with strict accordance with the plans and specifications therein, which were approved by said City and are on file with the City, including any and all addenda issued by the City, and with the other contract documents hereinafter enumerated.

**2. Payment for Project Services**

As full consideration for the Services to be performed by Contractor, City agrees to pay Contractor as set forth in accordance with the bid and not to exceed fee of **\$AMOUNT** for the project.

A monthly progress payment in the amount of ninety-five percent (95%) of the value of the work completed may be made every thirty (30) days upon application by the Contractor and certification by the Project Manager that such work has been completed.

Partial payments will be made once each month as the work satisfactorily progresses and after acceptance

by the authorized City representative. The progress estimates shall be based upon materials in place, or on the job site and invoiced, and labor expended thereon. From the total of the amount ascertained will be deducted an amount equivalent to five percent (5%) of the whole, which five percent (5%) will be retained by the City until after completion of the entire Contract in an acceptable manner. Any time after fifty percent (50%) of the value of the work has been completed, the City will make any of the remaining partial payments in full.

No such estimates or payments shall be required to be made, when, in the judgment of the City Project Manager, the work is not proceeding in accordance with the provision of the Contract, or when in his judgment the total value of the work done since last estimate amounts to less than Five Hundred Dollars (\$500.00).

The cost of materials conforming to the plans and specifications (materials being those which are required to be contained and incorporated in a finished contract bid item) delivered to the project and not at the time incorporated in the work, may also be included in the estimate for payment. No such estimate or payment shall be construed to be an acceptance of any defective work or improper material. The Contractor shall be responsible for, and shall not remove from the project any material that has been included in the estimate for payment.

Final payment shall be made upon the Project Manager certifying that the Contractor has satisfactorily completed the work in conformity with the Contract Documents.

**3. Time for Completion:**

The Contractor shall deliver the material and/or services called for in the specifications/proposal and within the delivery time specified and in accordance with the terms of the contract. Work shall be completed within [REDACTED] days from the Notice to Proceed issued by the City of Sparks Purchasing Division. The Contractor shall not alter or vary any terms or conditions contained or incorporated herein, including but not limited to, the quantity, price, delivery date or date designated as After Receipt of Order (ARO) or date for commencement or completion of services as mutually agreed upon, unless such alteration or variation is consented to in writing by a duly authorized representative of the City.

The City reserves the right to cancel resultant Contract upon ten days written notice in the event the type and quality of the product or work performance is unsatisfactory or in default, subject to Contractor's right to cure as outlined in termination clause.

This is a non-exclusive Contract and the City reserves the right to acquire the material and/or services at its discretion, from other sources during the term of this Contract.

**4. No Unlawful Discrimination:**

In connection with the performance of work under this contract, the contractor agrees not to discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, sexual orientation, gender identity or expression, or age, including, without limitation, with regard to employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including, without

limitation, apprenticeship. The contractor further agrees to insert this provision in all subcontracts hereunder, except subcontracts for standard commercial supplies or raw materials.

Any violation of these provisions by Contractor shall constitute a material breach of contract. In all cases where persons are employed in the construction of public works, preference must be given when the qualifications of the applicants are equal:

- A) First: To honorably discharged soldiers, sailors and marines of the United States who are citizens of the State of Nevada.
- B) Second: To other citizens of the State of Nevada

If the provisions of this section are not complied with by the contractor engaged on the public work, the contract is void, and any failure or refusal to comply with any of the provisions of this section renders any such contract void and subject to the exceptions contained in this section, no money may be paid out of the State Treasury or out of the treasury of any political subdivision of the State to any person employed on any work mentioned in this section unless there has been compliance with the provisions of this section. Any contractor engaged on a public work or any other person who violates any of the provisions of this section is guilty of a misdemeanor. The penalties provided for in this section do not apply where violations thereof are due to misrepresentations made by the employee or employees.

**5. No Illegal Harassment:**

Violation of the City's harassment policy, which is incorporated by reference and available from the Human Resource Division, by the Contractor, its officers, employees, agents, vendors, consultants, subcontractors and anyone from whom it is legally liable, while performing or failing to perform Contractor's duties under this Contract shall be considered a material breach of contract.

**6. Lawful Performance:**

Vendor shall abide by all Federal, State and Local Laws, Ordinances, Regulations, and Statutes as may be related to the performance of duties under this agreement. In addition, all applicable permits and licenses required shall be obtained by the vendor, at vendor's sole expense.

**7. Preferences (This Section  IS  IS NOT Applicable to this contract):**

To the extent Contractor has sought and qualified for a bidding preference and this project has a value of over \$250,000 pursuant to Nevada Revised Statutes Chapter 338, Contractor acknowledges and agrees that the following requirements will be adhered to, documented and attained for the duration of the Project:

- 1. At least 50 percent of the workers employed on the Project (including subcontractors) hold a valid driver's license or identification card issued by the Nevada Department of Motor Vehicles;
- 2. All vehicles used primarily for the public work will be (a) registered and (where applicable) partially apportioned to Nevada; or (b) registered in Nevada; and
- 3. The Contractor shall maintain and make available for inspection within Nevada all payroll records related to the Project.

Contractor recognizes and accepts that failure to comply with any requirements herein shall be a



material breach of the contract and entitle the City of Sparks to liquidated damages in the amount set by statute. In addition, the Contractor recognizes and accepts that failure to comply with any requirements herein may lose its certification for a preference in bidding and/or its ability to bid on any contracts for public works pursuant to NRS Chapter 338.

To the extent Contractor has sought and qualified for a bidding preference and this project has a value of over \$250,000 pursuant to Nevada Revised Statutes Chapter 338, each contract between the contractor, applicant or design-build team and a subcontractor must provide for the apportionment of liquidated damages assessed pursuant to this section if a person other than the Contractor was responsible for the breach of a contract for a public work caused by a failure to comply with a requirement of Items 1-5 within this section. The apportionment of liquidated damages must be in proportion to the responsibility of each party for the breach.

#### **8. Prevailing Wages:**

The Contractor and subcontractors shall be bound by and comply with all federal, state and local laws with regard to minimum wages, overtime work, hiring and discrimination, including Chapter 338 of the NRS, which is entitled, "Public Works Projects."

The Contractor shall ensure that all employees on the work site are paid in accordance with the CURRENT PREVAILING WAGE RATES AS APPROVED BY THE STATE LABOR COMMISSIONER, whenever the actual value of the Contract totals One Hundred Thousand Dollars (\$100,000) or more, or when required by the Supplementary Conditions. If a Change Order causes a Contract to exceed One Hundred Thousand Dollars (\$100,000), the State Labor Commissioner may audit the entire Contract period.

Questions involving the Prevailing Wage Rates for the City of Sparks should be referred to the Labor Commissioner, State of Nevada, at (775) 687-4850.

When federal money is associated with the project making the Contract subject to both state and federal wage rates, the Contractor shall not pay less than the higher rate when the two rates differ for similar kinds of labor.

- A. Posting of Minimum Wage Rates - In accordance with NRS, Chapter 338, Section 338.020, the Contractor shall post the hourly and daily rate of wages to be paid to each of the classes of mechanics and workers on the site of Work of this Contract in a place generally visible to the workers.
- B. Pursuant to NRS 338.060 and 338.070, the Contractor hereby agrees to forfeit, as a penalty to the City of Sparks, not less than Twenty Dollars (\$20) nor more than Fifty Dollars (\$50) for each calendar day or portion thereof that each worker employed on the Contract is paid less than the designated rate for any work done under the Contract, by the Contractor or any subcontractor under him, or is not reported to the City of Sparks as required by NRS 338.070.
- C. The contractor and each subcontractor shall keep or cause to be kept an accurate record showing, for each worker employed by the contractor or subcontractor:
  - (1) The name of the worker;

- (2) The occupation of the worker;
- (3) If the worker has a driver's license or identification card, an indication of the state or other jurisdiction that issued the license or card; and
- (4) The actual per diem, wages and benefits paid to the worker.

In addition, the contractor and each subcontractor shall keep or cause to be kept an accurate record showing, for each worker employed by the contractor or subcontractor who has a driver's license or identification card:

- (1) The name of the worker;
- (2) The driver's license number or identification card number of the worker; and
- (3) The state or other jurisdiction that issued the license or card.

D. The records in Section C above must be open at all reasonable hours to the inspection of the City of Sparks, and its officers and agents. A copy of the each record for each calendar Month for the General Contractor and all Sub-Contractors must be submitted to the City of Sparks no later than 15 days after the end of each month for the previous months' wages.

**9. Apprenticeship Utilization Act:**

Contractor acknowledges that the Nevada Legislature has enacted state laws requiring contractors engaged in vertical or horizontal construction who employ workers on one or more public works during a calendar year to use varying levels of apprentices on such public works. *See* NRS 338.01165; SB 82 (2023). Contractor acknowledges that Senate Bill 82 (2023) places compliance and reporting requirements on contractors and subcontractors engaged in public works project, and requires contractors and subcontractors engaged in public works projects to meet annual apprentice use thresholds set by state law, including obligations to provide the Nevada Labor Commissioner with supporting documentation when requested, and an obligation to provide an annual report to the Nevada Labor Commissioner documenting its compliance with Nevada apprenticeship requirements. Contractor acknowledges and certifies that it will comply with NRS 338.01165 and SB 82 (2023), as each may be amended in the future.

**10. Acceptance by the City:**

It is expressly understood and agreed that all materials provided and/or work done by the Contractor shall be subject to inspection and acceptance by the City at its discretion, and that any progress inspections and approval by the City of any item or work shall not forfeit the right of the City to require the correction of faulty workmanship or material at any time during the course of the work, although previously approved by oversight. Nothing herein contained shall relieve the Contractor of the responsibility for proper construction and maintenance of the work, materials and equipment required under the terms of this Contract until all work has been completed and accepted by the City.

**11. Waiver:**

No waiver of any term, provision or condition of this Contract, whether by conduct or otherwise, in any one or more instances, shall be deemed to be nor shall it be construed as a further or continuing waiver of any such term, provision or condition of this Contract. No waiver shall be effective unless it is in writing and signed by the party making it.

**12. Notices:**

All notices required to be given in writing by this Contract shall be deemed to be received (i) upon delivery if personally delivered, or (ii) when receipt is signed for if mailed by certified or registered mail, postage prepaid, or by express delivery service or courier, when addressed as follows (or sent to such other address as a Party may specify in a notice to the others):

PURCHASING MANAGER  
CITY OF SPARKS  
431 PRATER WAY  
PO BOX 857  
SPARKS, NV 89432-0857

CONTRACTOR:  
CONTACT  
CONTRACTORNAME  
ADDRESS  
CITY, STATE ZIP  
e-mail:

**13. Arbitration:**

Any and all disputes, controversies or claims arising under or in connection with this Contract, including without limitation, fraud in the inducement of this Contract, or the general validity or enforceability of this Contract, shall be governed by the laws of the State of Nevada without giving effect to conflicts of law principles, may be submitted to binding arbitration before one arbitrator, and shall be conducted in accordance with the Commercial Arbitration Rules of the American Arbitration Association in a private manner in Washoe County, Nevada. This award shall be final and judgment may be entered upon it in any court having jurisdiction thereof. In reaching this final award, the arbitrator shall have no authority to change or modify any provision of this Contract. All other expenses of arbitration shall be borne equally by the parties. All fees, including legal fees, shall be borne by the party who incurred them. All costs of enforcement shall be borne by the losing party. Each party shall have the right to discovery in accordance with the Nevada Rules of Civil Procedure.

**14. Jurisdiction and Venue:**

In the event the arbitration award is challenged, any action or proceeding seeking to do so must be brought in the courts of the State of Nevada, County of Washoe, or if the party can acquire subject-matter jurisdiction, in the United States District Court for the District of Nevada in the City of Reno. Each of the parties consents to the personal jurisdiction of such courts (and of the appropriate appellate courts) in any such action or proceeding and waives any objection to venue laid therein. Process in any action or proceeding referred to in the preceding sentence may be served on either party by sending it certified mail to the respective addresses designated for notice.

**15. Indemnification:**

To the fullest extent permitted by law, upon award, Contractor shall hold harmless, indemnify, defend and protect City, its affiliates, officers, agents, employees, volunteers, successors and assigns (“Indemnified Parties”), and each of them from and against any and all claims, demands, causes of action, damages, costs, expenses, actual attorney’s fees, losses or liabilities, in law or in equity, of every kind and nature whatsoever (“Claims”) arising out of or related to any act or omission of Contractor, its employees, agents, representatives, or Subcontractors in any way related to the performance of work under this Agreement by Contractor, or to work performed by others under the direction or supervision of Contractor, including but not limited to:

1. Personal injury, including but not limited to bodily injury, emotional injury, sickness or disease, or death to persons;
2. Damage to property of anyone, including loss of use thereof;
3. Penalties from violation of any law or regulation caused by Contractor's action or inaction;
4. Failure of Contractor to comply with the Insurance requirements established under this Agreement;
5. Any violation by Contractor of any law or regulation in any way related to the occupational safety and health of employees.

In determining the nature of the claim against City, the incident underlying the claim shall determine the nature of the claim, notwithstanding the form of the allegations against City.

If City's personnel are involved in defending such actions, Contractor shall reimburse City for the time and costs spent by such personnel at the rate charged City for such services by private professionals.

**In cases of professional service agreements, requiring professional liability coverage:**

If the insurer by which a Consultant is insured against professional liability does not so defend the City and applicable agents and/or staff, and the Consultant is adjudicated to be liable by a trier of fact, the City shall be entitled to reasonable attorney's fees and costs to be paid to the City by the Consultant in an amount which is proportionate to the liability of the of the Consultant.

Nothing in this contract shall be interpreted to waive nor does the City, by entering into this contract, waive any of the provisions found in Chapter 41 of the Nevada Revised Statutes.

**16. Licenses and Permits:**

The Contractor shall procure at his own expense all necessary licenses and permits and shall adhere to all the laws, regulations and ordinances applicable to the performance of this Contract.

All Contractors, Sub-Contractors and Suppliers doing business within the City of Sparks are required to obtain a current business license from the City of Sparks prior to commencement of this contract. Per Sparks Municipal Code Section 5.08.020A: "It is unlawful for any person to transact business in the City without first having obtained a license from the City to do so and without complying with all applicable provisions of this title and paying the fee therefore."

**17. Insurance:**

BIDDERS' ATTENTION IS DIRECTED TO THE INSURANCE REQUIREMENTS BELOW. IT IS HIGHLY RECOMMENDED THAT BIDDERS CONFER WITH THEIR RESPECTIVE INSURANCE CARRIERS OR BROKERS TO DETERMINE IN ADVANCE OF BID SUBMISSION THE AVAILABILITY OF INSURANCE CERTIFICATES AND ENDORSEMENTS AS PRESCRIBED AND PROVIDED HEREIN. IF THE APPARENT LOW BIDDER FAILS TO COMPLY STRICTLY WITH THE INSURANCE REQUIREMENTS, THAT BIDDER MAY BE DISQUALIFIED FROM AWARD OF THE CONTRACT.

**The City may, unless otherwise required by law, waive or reduce the insurance requirements itemized here, at the discretion of the city’s Contracts and Risk Manager.**

Should work be required on City premises or within the public right-of-way, upon award of the contract, the bidder shall provide proof of insurance for the types of coverage, limits of insurance and other terms specified herein, prior to initiation of any services under City, Bid, Proposal or Contract. Coverage shall be from a company authorized to transact business in the State of Nevada and the City of Sparks and shall meet the following minimum specifications:

Contractor shall at its own expense carry and maintain at all times the following insurance coverage and limits of insurance no less than the following or the amount customarily carried by Contractor or any of its subcontractors, whichever is greater. Contractor shall also cause each subcontractor employed by Contractor to purchase and maintain insurance of the type specified herein. All insurers must have AM Best rating not less than A-VII, and be acceptable to the City. Contractor shall furnish copies of certificates of insurance evidencing coverage for itself and for each subcontractor. Failure to maintain the required insurance may result in termination of this contract at City’s option. If Contractor fails to maintain the insurance as set forth herein, City shall have the right, but not the obligation, to purchase said insurance at Contractor’s expense.

Contractor shall provide proof of insurance for the lines of coverage, limits of insurance and other terms specified below prior to initiation of any services. Coverage shall be from a company authorized to transact business in the State of Nevada and the City of Sparks. Contractor and any of its subcontractors shall carry and maintain coverage and limits no less than the following or the amount customarily carried by Contractor or any of its subcontractors, whichever is greater.

<b>Applicable to this Contract</b>	<b>Insurance Type</b>	<b>Minimum Limit</b>	<b>Insurance Certificate</b>	<b>Additional Insured</b>	<b>Waiver of Subrogation</b>
<b>Yes</b>	General Liability/Umbrella (Excess) Liability	\$2,000,000	✓	✓	✓
<b>Yes</b>	Automobile Liability	\$1,000,000	✓	✓	
<b>Yes</b>	Workers’ Compensation	Statutory	✓	N/A	✓
<b>Yes</b>	Employer’s Liability	\$1,000,000	✓	N/A	
<b>No</b>	Professional Liability	\$1,000,000	✓	N/A	N/A
<b>No</b>	Pollution Legal Liability	\$1,000,000	✓	N/A	N/A

**Commercial General Liability**

Contractor shall carry and maintain Commercial General Liability (CGL) and, if necessary to meet required limits of insurance, commercial umbrella/excess liability insurance with a total limit of not less than the limits specified herein.

For contracts that are for the construction or improvement of public facilities, the Contractor shall obtain and maintain products and completed operations liability coverage through the statute of repose after completion of the project. Continuing commercial umbrella coverage, if any, shall include liability coverage for damage to the insured's completed work equivalent to that provided under ISO form CG 00 01.

There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse, underground property damage, or damage to the named insured's work unless Subcontractor carries and maintains separate policies providing such coverage and provides Contractor evidence of insurance confirming the coverage.

***Minimum Limits of Insurance***

**\$2,000,000** Each Occurrence Limit for bodily injury and property damage

**\$2,000,000** General Aggregate Limit

**\$2,000,000** Products and Completed Operations Aggregate Limit

**\$10,000** Medical Expense Limit

If Commercial General Liability Insurance or other form with a general aggregate limit is used, it shall be revised to apply separately to this PROJECT or LOCATION.

***Coverage Form***

Coverage shall be at least as broad as the unmodified Insurance Services Office (ISO) Commercial General Liability (CGL) "Occurrence" form CG 00 01 04/13 or substitute form providing equivalent coverage and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).

***Additional Insured***

City, its officers, agents, employees, and volunteers are to be included as insureds using the applicable ISO additional insured endorsement(s) or substitute forms providing equivalent coverage, in respects to damages and defense arising from: activities performed by or on behalf of Contractor, including the insured's general supervision of Contractor; products and completed operations of Contractor; premises owned, occupied, or used by Contractor. The coverage shall contain no special limitations on the scope of protection afforded to City, its officers, employees, or volunteers. Additional insured status for City shall apply until the expiration of time within which a claimant can bring suit per applicable state law.

***Primary and Non-Contributory***

Contractor's insurance coverage shall apply as primary insurance with respect to any other insurance or self-insurance programs afforded to City, its officers, agents, employees, and volunteers. There shall be no endorsement or modification of the CGL to make it excess over other available insurance; alternatively, if the CGL states that it is excess or pro rata, the policy shall be endorsed to be primary with respect to the additional insured. Any insurance or self-insurance maintained by City, its officers, employees, or volunteers shall be excess of Contractor's insurance and shall not contribute with it in any way.

***Waiver of Subrogation***

Contractor waives all rights against City and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability or commercial umbrella liability insurance maintained pursuant to this agreement. Insurer shall endorse CGL policy as required to waive subrogation against the City with respect to any loss paid under the policy.

### ***Endorsements***

Policy forms or endorsements are required confirming coverage for all required additional insureds. The forms or endorsements for CGL shall be at least as broad as the unmodified ISO additional insured endorsement CGO 20 10 07/04 and CG 20 37 07/04 or substitute forms providing additional insured coverage for products and completed operations.

A waiver of subrogation in favor of City shall be endorsed to the policy using an unmodified Waiver of Transfer of Rights of Recovery of Others to Us ISO CG 24 04 05 09, or a substitute form providing equivalent coverage.

### ***Electronic Data Liability***

If any underground work will be performed, Contractor shall maintain electronic data liability insurance applicable to the Project and insuring against liability arising out of the loss of, loss of use of, damage to, corruption of, inability to access, or inability to manipulate electronic data. This coverage shall be maintained with a limit of liability of not less than \$1,000,000 and provide coverage at least as broad as electronic data liability coverage form CG 04 37 (or substitute form providing equivalent coverage).

### ***Railroad Protective Liability***

For any construction or demolition work within fifty (50) feet of a railroad, Contractor shall maintain Railroad Protective Liability insurance on behalf of and in the name of the railroad, as named insured, with a limit of \$6,000,000 per occurrence or higher limit if required by the railroad. Contractor shall also ensure that any exclusions pertaining to the indemnification of a railroad are removed from its CGL policy or that ISO form CG 24 17 (Contractual Liability-Railroads Endorsements) is included in the coverage.

### **Business Automobile Liability**

#### ***Minimum Limits of Insurance***

**\$1,000,000** Combined Single Limit per accident for bodily injury and property damage or the limit customarily carried by Contractor, whichever is greater. No aggregate limit may apply. Coverage may be combined with Excess/Umbrella Liability coverage to meet the required limit.

#### ***Coverage Form***

Coverage shall be at least as broad as the unmodified Insurance Services Office (ISO) Business Automobile Coverage form CA 00 01 10/13, CA 00 25 10/13, CA 00 20 10/13 or substitute form providing equivalent coverage. Such insurance shall cover liability arising out of any auto (including owned, hired, and non-owned autos).

Pollution liability coverage at least as broad as that provided under the ISO pollution liability—broadened coverage for covered autos endorsement (CA 99 48) shall be provided, and the Motor Carrier Act endorsement (MCS 90) shall be attached for all contracts involving transportation of “hazardous

material” as this term is defined by applicable law, including, but not limited to, waste, asbestos, fungi, bacteria and mold.

***Additional Insured***

City, its officers, agents, employees, and volunteers are to be included as insureds with respect to damages and defense arising from the ownership, maintenance or use of automobiles owned, leased, hired, or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to City, its officers, employees, or volunteers. Additional insured status for City shall apply until the expiration of time within which a claimant can bring suit per applicable state law.

***Endorsements***

A policy endorsement is required listing all required additional insureds. The endorsement for Business Automobile Liability shall be at least as broad as the unmodified ISO CA 20 48 10/13 or a substitute form confirming City’s insured status for Liability Coverage under the Who Is An Insured Provision contained in Section II of the coverage form ISO CA 00 01 10/13.

**Waiver of Subrogation.**

Contractor waives all rights against City, its officers, agents, employees, and volunteers for recovery of damages to the extent these damages are covered by the commercial general liability or commercial umbrella liability insurance maintained pursuant to this agreement. Contractor’s insurer shall endorse policy to waive subrogation against City with respect to any loss paid under the policy.

**Workers’ Compensation and Employer’s Liability**

Contractor shall carry and maintain workers’ compensation and employer’s liability insurance meeting the statutory requirements of the State of Nevada, including but not limited to NRS 616B.627 and NRS 617.210 or provide proof that compliance with the provisions of Nevada Revised Statutes Chapters 616A-D and all other related chapters is not required. It is understood and agreed that there shall be no coverage provided for Contractor or any Subcontractor of the Contractor by the City. Contractor agrees, as a precondition to the performance of any work under this Agreement and as a precondition to any obligation of the City to make any payment under this Agreement to provide City with a certificate issued by an insurer in accordance with NRS 616B.627 and with a certificate of an insurer showing coverage pursuant to NRS 617.210.

It is further understood and agreed by and between City and Contractor that Contractor shall procure, pay for and maintain the above-mentioned coverage at Contractor's sole cost and expense.

Should Contractor be self-funded for workers’ compensation and employer’s liability insurance, Contractor shall so notify City in writing prior to the signing of this Contract. City reserves the right to approve said retentions, and may request additional documentation, financial or otherwise, for review prior to the signing of this Contract.

Upon completion of the project, Contractor shall, if requested by City, provide a Final Certificate for itself and each Subcontractor showing that Contractor and each Subcontractor had maintained the required Workers Compensation and Employer’s Liability by paying all premiums due throughout the entire course of the project.



Nevada law allows the following to reject workers' compensation coverage if they do not use employees or subcontractors in the performance of work under the contract:

- Sole proprietors (NRS 616B.627 and NRS 617.210)
- Unpaid officers of quasi-public, private or nonprofit corporations (NRS 616B.624 and NRS 617.207)
- Unpaid managers of limited liability companies (NRS 616B.624 and NRS 617.207)
- An officer or manager of a corporation or limited liability company who owns the corporation or company (NRS 616B.624 and NRS 617.207)

If a contractor has rejected workers' compensation coverage under applicable Nevada law, the contractor must indicate the basis for the rejection of coverage and complete, sign and have notarized an Affidavit of Rejection of Coverage. The Affidavit must be completed, signed and notarized prior to performance of any work.

***Minimum Limits of Insurance***

Workers' Compensation:	Statutory Limits
Employer's Liability:	<b>\$1,000,000</b> Bodily Injury by Accident – Each Accident
	<b>\$1,000,000</b> Bodily Injury by Disease – Each Employee
	<b>\$1,000,000</b> Bodily Injury by Disease – Policy Limit

***Coverage Form***

Coverage shall be at least as broad as the unmodified National Council on Compensation Insurance (NCCI) Workers Compensation and Employer's Liability coverage form WC 00 00 07/11 or substitute form providing equivalent coverage.

**OTHER INSURANCE COVERAGES (IF APPLICABLE)**

**Professional Liability Insurance (if Applicable)** \$1,000,000 each claim limits of liability or whatever limit is customarily carried by the Contractor, whichever is greater, for design, design-build or any type of professional services. If coverage is required on a claims-made or claims-made and reported basis, any applicable retroactive or pending & prior litigation dates must precede the effective date of this contract. Continuous coverage shall be maintained, or an extended reporting period shall be obtained for a period of at least three (3) years following completion of the project.

**Contractors Pollution Liability Insurance (If Applicable)**- \$1,000,000 per occurrence and \$2,000,000 aggregate or whatever amount is acceptable to the City for any exposure to "hazardous materials" as this term is defined in applicable law, including but not limited to waste, asbestos, fungi, bacterial or mold.

Coverage shall apply to bodily injury; property damage, including loss of use of damaged property or of property that has not been physically injured; cleanup costs; and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims.

City shall be included as an insured under Contractor's pollution liability insurance.

If coverage is required on a claims-made or claims-made and reported basis, any applicable retroactive or pending & prior litigation dates must precede the effective date of this contract. Continuous coverage shall be maintained, or an extended reporting period shall be obtained for a period of at least three (3) years following completion of the project.

If the scope of services as defined in this contract includes the disposal of any hazardous materials from the job site, Contractor must furnish to City evidence of pollution liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under this contract. Coverage certified to the City under this section must be maintained in minimum amounts of \$1,000,000 per loss, with an annual aggregate of at least \$2,000,000.

Lower tier sub-subcontractors, Truckers, Suppliers: Evidence confirming lower tier subcontractors, truckers and suppliers are maintaining valid insurance prior to beginning work on the project to meet the requirements set forth herein on Subcontractor, including but not limited to all additional insured requirements of Subcontractor.

#### **ALL COVERAGES**

Coverage shall not be suspended, voided, canceled, or non-renewed by either CONTRACTOR or by the insurer, reduced in coverage or in limits except after thirty (30) days' prior written notice has been given to CITY except for ten (10) days' notice for nonpayment of premium.

#### **DEDUCTIBLES AND RETENTIONS**

Any deductibles or self-insured retentions that exceed \$100,000.00 per occurrence or claim must be declared to and approved by the City's Contracts and Risk Manager and prior to signing this Contract. City is entitled to request and receive additional documentation, financial or otherwise, prior to giving its approval of the deductibles and self-insured retentions. Any changes to the deductibles or self-insured retentions made during the term of this Contract or during the term of any policy must be approved by City's Contracts and Purchasing Manager prior to the change taking effect. Contractor is responsible for any losses within deductibles or self-insured retentions.

#### **OTHER INSURANCE PROVISIONS**

Should City and Contractor agree that higher coverage limits are needed warranting a project policy, project coverage shall be purchased and the premium for limits exceeding the above amount may be borne by City. City retains the option to purchase project insurance through Contractor's insurer or its own source.

Any failure to comply with reporting provisions of the policies shall not affect coverage provided to City, its officers, agents, employees, or volunteers.

#### **ACCEPTABILITY OF INSURERS**

Insurance is to be placed with insurers with a Best's rating of no less than A-VII and acceptable to the City. City, with the approval of the Risk Manager, may accept coverage with carriers having lower Best's ratings upon review of financial information concerning Contractor and insurance carrier. City reserves the right to require that Contractor's insurer be a licensed and admitted insurer in the State of Nevada, or meet any applicable state and federal laws and regulations for non-admitted insurance placement.

## **VERIFICATION OF COVERAGE**

Contractor shall furnish City with certificates of insurance and with original endorsements affecting coverage required by this contract. The certificates and endorsements for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

Prior to the start of any Work, Contractor must provide the following documents to City of Sparks, Attention: Purchasing Division, P.O. Box 857, Sparks, NV 89432-0857:

- A. Certificate of Insurance.** Contractor must provide a Certificate of Insurance form to the City of Sparks to evidence the insurance policies and coverage required of Contractor.
  
- B. Additional Insured Endorsements.** An original Additional Insured Endorsement, signed by an authorized insurance company representative, must be submitted to the City of Sparks, by attachment to the Certificate of Insurance, to evidence the endorsement of the City of Sparks as additional insured.
  
- C. Policy Cancellation Endorsement.** Except for ten (10) days' notice for non-payment of premium, each insurance policy shall be endorsed to specify that without thirty (30) days prior written notice to the City of Sparks, the policy shall not be suspended, voided, cancelled or non-renewed, and shall provide that notices required by this paragraph shall be sent by certified mailed to the address specified above. A copy of this signed endorsement must be attached to the Certificate of Insurance. If endorsements are not available, Contractor shall be responsible to provide prior written notice to City as soon as practicable upon receipt of any notice of cancellation, non-renewal, reduction in required limits or other material change in the insurance required under this Agreement.
  
- D. Bonds (as Applicable).** Bonds as required and/or defined in the original bid documents.

**All certificates and endorsements are to be addressed to the City of Sparks, Purchasing Division and be received and approved by City before work commences.** The City reserves the right to require complete certified copies of all required insurance policies at any time.

## **SUBCONTRACTORS**

Contractor shall include all Subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each Subcontractor. All coverages for Subcontractors shall be subject to all the requirements stated herein.

## **MISCELLANEOUS CONDITIONS**

1. Contractor shall be responsible for and remedy all damage or loss to any property, including property of City, caused in whole or in part by Contractor, any Subcontractor, or anyone employed, directed, or supervised by Contractor.
2. Nothing herein contained shall be construed as limiting in any way the extent to which Contractor may be held responsible for payment of damages to persons or property resulting from its operations or the operations of any Subcontractors under it, and such coverage and

limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to City in this contract.

3. In addition to any other remedies City may have if Contractor fails to provide or maintain any insurance policies or policy endorsements to the extent and within the time herein required, City may, at its sole option:
  - a. Purchase such insurance to cover any risk for which City may be liable through the operations of Contractor under this Agreement and deduct or retain the amount of the premiums for such insurance from any sums due under the Agreement;
  - b. Order Contractor to stop work under this Agreement and/or withhold any payments which become due Contractor here under until Contractor demonstrates compliance with the requirements hereof; or,
  - c. Terminate the Agreement.
4. If Contractor's liability policies do not contain the standard ISO separation of insureds condition, or a substantially similar clause, they shall be endorsed to provide cross-liability coverage.

#### **18. Liquidated Damages:**

If the Product is not delivered/Project is not completed within the time stipulated in the bid, the Contractor shall pay to the City of Sparks as fixed, agreed and liquidated damages for delay and not as a penalty (it being impossible to determine the actual damages occasioned by the delay) **\$AMT** for each **\_\_\_\_\_** day of delay until delivery is completed; the Contractor shall be liable to the City of Sparks for the amount herein. This amount may be deducted from money due or to become due to the Contractor as compensation under this proposal in the event the Contractor fails to meet delivery schedules or product specifications.

#### **19. Material Breach of Contract:**

In the event Contractor fails to deliver the product and services as contracted for herein, to the satisfaction of the City of Sparks or otherwise fails to perform any provisions of this Contract, the City, after providing five (5) days written notice and Contractor's failure to cure such breach within the time specified in the notice, may without waiving any other remedy, make good the deficiencies and deduct the actual cost of providing alternative products and/or services from payment due the Contractor. Non-performance after the first notice of non-performance shall be considered a material breach of contract.

#### **20. Force Majeure:**

Neither party to the Contract shall be held responsible for delay or default caused by fire, riot, acts of God, and/or war which is beyond that party's reasonable control. City may terminate the Contract upon written notice after determining such delay or default will reasonably prevent successful performance of the Contract.

#### **21. Termination:**

The City may terminate the Contract for material breach of contract upon ten (10) days written notice and recover all damages, deducting any amount still due the Contractor from damages owed to the City, or seek other remedy including action against all bonds. The Contractor may terminate the Contract for material breach of contract upon thirty (30) days written notice to the City.

**22. Assignment:**

All of the terms, conditions and provisions of this Contract, and any amendments thereto, shall inure to the benefit of and be binding upon the parties hereto, and their respective successors and assigns. The Contractor shall not assign this Contract without the written consent of the City which will not be unreasonably withheld.

**23. Entire Contract:**

This Contract constitutes the entire agreement of the parties and shall supersede all prior offers, negotiations, agreements and contracts whether written or oral. Any modifications to the terms and conditions of this Contract must be in writing and signed by both parties.

**24. Severability:**

If any part of this Contract is found to be void it will not affect the validity of the remaining terms of this Contract which will remain in full force and effect.

**25. Headings:**

Paragraph titles or captions contained in this Contract are inserted only as a matter of convenience and for reference only, and in no way define, limit, extend, or describe the scope of this Contract or the intent of any provision herein.

**26. Singular Includes the Plural; Gender; Title Reference:**

Whenever the singular number is used in this Contract and when required by the context, the same shall include the plural, and the use of any gender, be it masculine, feminine or neuter, shall include all of the genders, and the word "person" or "entity" shall include corporation, firm, partnership, or any other combination or association.

The use of the title "Bidder", "Vendor", "Contractor" or "Consultant" within this contract or associated bid documents shall be deemed interchangeable and shall refer to the person or entity with whom the City of Sparks is contracting for the service or product referenced within this contract.

**27. Execution:**

The parties agree to execute such additional documents and to take such additional actions as are reasonably necessary or desirable to carry out the purposes hereof. They also agree, acknowledge and represent that all corporate authorizations have been obtained for the execution of this Contract and for the compliance with each and every term hereof. Each undersigned officer, representative or employee represents that he or she has the authority to execute this Contract on behalf of the party for whom he or she is signing.

**THIS SPACE INTENTIONALLY LEFT BLANK**

IN WITNESS WHEREOF, the City of Sparks has caused this Contract to be executed by its officers thereunto duly authorized and the Consultant has subscribed same, all on the day and year first above written.

\_\_\_\_\_  
(Vendor)

CITY OF SPARKS, NEVADA  
A Municipal Corporation

By: \_\_\_\_\_

By: \_\_\_\_\_  
Ed Lawson, Mayor

\_\_\_\_\_  
(Title)

APPROVED AS TO FORM

ATTEST:

\_\_\_\_\_  
City Attorney

\_\_\_\_\_  
City Clerk

# CITY OF SPARKS, NEVADA - BOND OF FAITHFUL PERFORMANCE

Bid #: \_\_\_\_\_

Bond #: \_\_\_\_\_

Surety Rating: \_\_\_\_\_

NV License #: \_\_\_\_\_

Appt. Agent Countersigning - List below with address

KNOW ALL MEN BY THESE PRESENTS: That WHEREAS, the City of Sparks in the State of Nevada has awarded to **CONTRACTORNAME** hereinafter designated as the "Principal" a contract for Bid # **23/24-005**, PWP # **WA-2024-131**, for the **FIRE STATION #6 CONSTRUCTION PROJECT**.

WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful and proper performance of the Contract and the Bonding Company has an "A" or better rating with Moody's or A.M. Best and T-Listed with the U.S. Treasury Department;

NOW, THEREFORE, we the Principal and \_\_\_\_\_ as Surety, are held and firmly bound unto the City of Sparks in the State of Nevada, in the penal sum of **WRITTENAMOUNT** dollars (**\$AMOUNT**), lawful money of the United States, being not less than one hundred percent (100%) of the estimated contract cost of the work, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the above bound Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and faithfully perform the covenants, conditions and agreements in the said contract and any alterations made as therein provided on his or their part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the City of Sparks in the State of Nevada, its officers and agents as therein stipulated, then this obligation shall become null and void; otherwise, it shall be and remain in full force and virtue.

As a condition precedent to the satisfactory completion of the said contract, the above obligation shall hold good for a period of one (1) year after the completion and acceptance of the said work, during which time, if the above bounden principal, his or its heirs, executors, administrators, successors or assigns shall fail to make full, complete and satisfactory repair and replacements or totally protect the said City of Sparks in the State of Nevada from loss or damage made evident during said period of one (1) year from the date of acceptance of said works, and resulting from or caused by defective materials or faulty workmanship in the prosecution of the work done, the obligation in the said sum of **WRITTENAMOUNT** dollars (**\$AMOUNT**), shall remain in full force and virtue; otherwise the above obligation shall be void.

And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in anyway effect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract, to the work or to the specifications.

IN WITNESS WHEREOF, the above bound parties have executed this instrument under their seals this \_\_\_\_ day of \_\_\_\_\_, 20\_\_, the name and corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

\_\_\_\_\_  
\_\_\_\_\_  
Principal

By \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Surety  
By \_\_\_\_\_



# CITY OF SPARKS, NEVADA – Payment Bond – Labor & Materials

Bid #: \_\_\_\_\_

Bond #: \_\_\_\_\_

Surety Rating: \_\_\_\_\_

NV License #: \_\_\_\_\_

Appt. Agent Countersigning - List below with address

KNOW ALL MEN BY THESE PRESENTS: That WHEREAS, the City of Sparks in the State of Nevada, has awarded to **CONTRACTORNAME** hereinafter designated as the “Principal” a contract for Bid # **23/24-005**, PWP # **WA-2024-131**, for the **FIRE STATION #6 CONSTRUCTION PROJECT**.

WHEREAS, said Principal is required under the terms of said contract to furnish a Bond for the faithful and proper performance of the Contract and the Bonding Company has an “A” or better rating with Moody’s or A.M. Best and T-Listed with the U.S. Treasury Department;

NOW, THEREFORE, we, the Principal, and \_\_\_\_\_ as Surety, are held and firmly bound unto the City of Sparks in the State of Nevada, in the penal sum of **WRITTENAMOUNT** dollars (**\$AMOUNT**), lawful money of the United States, being not less than one hundred percent (100%) of the estimated contract cost of the work for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally firmly by these presents.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if the above bounden principal, his or its heirs, executors, administrators, successors, or assigns, shall fail to pay for any materials, provisions, provender or other supplies, implements, or machinery used in, upon, for, or about the performance of the work contracted to be done or for any work or labor thereon of any kind, or for amounts due under the Unemployment Compensation Law with respect to such work or labor as required by the provisions of NRS 612, and provided that the claimant shall have complied with the provisions of said law, the Surety hereon will pay for the same within thirty (30) calendar days an amount not exceeding the sum specified in this bond, then the above obligation shall be null and void; otherwise to remain in full force and account. In case suit is brought upon this bond, the said Surety agrees to pay a reasonable attorney’s fees to be fixed by the Court.

The Bond shall insure to the benefit of any and all persons, companies and corporations entitled to file claims under NRS 339 as to give a right of action to them or their assigns in any suit brought upon this Bond.

IN WITNESS WHEREOF, the above bound parties have executed this instrument under their seals this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

\_\_\_\_\_

\_\_\_\_\_

Principal

By \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Surety

By \_\_\_\_\_