Rockwall INDEPENDENT SCHOOL DISTRICT

Request for COMPETITIVE SEALED PROPOSALS

RFCSP 2526.03-003
NOC HVAC Renovation Project

Date	Event
March 6, 2026	1st Advertisement / Issue Date
March 10, 2026	Pre-Bid Conference – 2:30 P.M. (CST)
March 13, 2026	Last day to submit questions – 12:00 P.M. (CST)
March 16 – 20, 2026	RISD Spring Break
March 31, 2026	Deadline for Responses – 2:30 P.M. (CST)
April 20, 2026	Recommendation to RISD Board of Trustees

** The District will make every effort to adhere to this schedule; however, dates are subject to change. Any changes will be posted in the form of an addendum on the RISD website. Additional addendums may be posted at the discretion of RISD. Potential respondents are responsible for watching the website for such publications.*

Deliver Sealed Responses to:
Rockwall ISD Administration Building
Purchasing Department
1050 Williams Street
Rockwall, Texas 75087

Rockwall ISD Purchasing Department:
(Contact during Procurement)
Jana Hunter, MBA, RTSBA
Director of Purchasing
972-771-0605
jana.hunter@rockwallisd.org

Rockwall ISD Operations Department:
(Contact during Project)
Tim Lyssy
Director of Project Planning and Construction
972-771-0605
Tim.lyssy@rockwallisd.org

Pre-Bid Information:
March 10, 2026 – 2:30 P.M.
RISD Administration Bldg.

NOTICE

The Rockwall Independent School District (RISD) is soliciting proposals per the specifications stated elsewhere in this solicitation document. A response to this solicitation is an offer to contract with Rockwall ISD and its members based on the specifications and standard terms and conditions contained in the bid document.

Respondents are cautioned to read this document completely and submit all documents. Each respondent, by submitting a response, represents that he/she has read and understands the proposal. Failure to examine the documents will be at the vendor's risk.

Respondents shall familiarize themselves with existing conditions in the material and labor markets prior to submission of an offer. The fact that an offer is submitted will be construed by the RISD Board of Trustees to indicate that the respondent agrees to carry out the furnishing of products and services in full accordance with the specifications and other contract documents not withstanding existing material and labor market conditions. A signed, submitted proposal constitutes an offer to perform the work and/or deliver the product(s) and/or services specified in the solicitation.

The vendor should propose his/her lowest and best price. All pricing information shall be entered on the proposal in ink or typewritten. Pricing should include packaging and transportation unless otherwise noted by the vendor.

If the vendor is awarded a contract under this solicitation, the prices proposed by the vendor shall remain fixed and firm during the term of the contract, provided, however that the vendor may offer incentive discounts from this fixed price to the District at any time during the contractual term.

Jana Hunter

Jana Hunter, MBA, RTSBA
Director of Purchasing

March 6,2026
Release Date

DISTRICT OVERVIEW

Rockwall ISD, situated in Rockwall County, Texas, comprises approximately two-thirds of the county's area and shares the county's boundary lines on the North, West and South. The eastern boundary of the district is an irregular line running through the town of Fate.

The District currently has 21 campuses comprised of 16 elementary schools, 3 middle schools, 2 high schools, a College and Career Academy and an alternative school. The District currently serves approximately 18,500 students and employs approximately 2300 employees.

Rockwall ISD has grown by more than 3,000 over the last decade and is expected to grow by nearly 6,000 students by 2030.

Rockwall ISD's Call to Action: Rockwall ISD empowers learners to embody independence, value relationships, and achieve excellence as thriving members of a dynamic community.

We believe that:

- Collaborative relationships create a culture where learners thrive.
- An effective learning environment is collaborative, safe, challenging, and responsive to the diverse needs of all students.
- Learning is a partnership that engages all members of our community to empower empathetic and responsible citizens for success among themselves.
- All learners deserve to be challenged in preparation for lifelong learning and future success.

Core Values:

- Relationships
- Innovation
- Excellence

Rockwall INDEPENDENT SCHOOL DISTRICT

Additional information about Rockwall ISD can be obtained on its website: www.rockwallisd.com

CODE OF CONDUCT

Vendors and their suppliers, installers and all others working on Rockwall ISD facilities are required to understand and adhere to the following rules and responsibilities. Failure to comply with the following rules and responsibilities may result in a work's removal from the facilities and/or the termination of all subcontractor's contract. Vendors are responsible for the suppliers and installers adherence to these policies. All personnel working on RISD facilities will indicate their understanding and agreement to comply with these rules and responsibilities by submitting a response to this solicitation.

1. Vendor's employees, installers and suppliers who will be entering the district should check in with the Rockwall ISD designated representative.
2. Vendor's employees, installers and suppliers must wear picture ID badges while on Rockwall ISD property.
3. The use of any tobacco products is prohibited on district property. These prohibited items include but are not limited to cigarettes, cigars, vapes and smokeless tobacco.
4. Drugs and alcoholic beverages are prohibited.
5. The use of vulgar or improper language is prohibited.
6. Unacceptable behavior including physical or verbal intimidation, horseplay, or fighting by any individual on district property will result in immediate remove from property.
7. School requirements may occasionally result in the untimely termination of a subcontractor's daily activities. Vendors are expected to anticipate and understand these circumstances and work with RISD to make-up any scheduling.
8. All contact with student is strictly prohibited.
9. Vendor's employees, installers and suppliers must be properly dressed in work attire which includes the use of proper work shoes and personal protection equipment (as needed).
10. Vendor's employees, installers and suppliers will promptly leave the premises at the end of each work shift or once business purpose has been served.
11. Vendor's employees, installers and suppliers will comply with all state and district rules regarding weapon free zones.
12. Vendor's employees, installers and suppliers shall submit such background information as may be requested by Rockwall ISD to perform criminal background evaluations/investigations.
13. No person who has charges pending or who has been convicted, received probation or deferred adjudication for the following shall be engaged to work on RISD property where students are present: Any offense against a child, any sex offense, any crimes against persons involving weapons or violence, any felony offense against property; or any offense that Rockwall ISD determines to compromise the safety and well-being of staff, students and/or property.

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STANDARD TERMS AND CONDITIONS

The following instructions by the Rockwall Independent School District are intended to afford potential respondents an equal opportunity to participate in the solicitation process. The following Terms and Conditions are standard for the District and apply to all types of purchasing, including this solicitation. In these Terms and Conditions, the terms *respondent, contractor*, *proposer*, *vendor*, and/or *bidder* refer to the person/firm that submits the offer to this solicitation document. The terms *RISD*, *owner*, *district*, and/or *government entity* refer to Rockwall Independent School District.

The documents contained in this solicitation represent the potential agreement between the successful respondent and the school district and supersedes any prior discussions, negotiations, representations, agreements, written or oral.

Any specifications, details, or specific instructions for this solicitation will be found following these Standard Terms and Conditions. Some of the Standard Terms and Conditions may not be applicable to a specific bid or proposal. To the extent each of the terms and conditions is applicable, these shall be deemed to be part of the vendor's bid or proposal documents. If there are specific terms and conditions contained in the bid or proposal documents which are inconsistent with the Standard Terms and Conditions, the specific terms and conditions in the bid and solicitation documents shall control. By submitting a bid or proposal, each vendor or proposer agrees to waive any claims it has or may have against the Owner, the Architect, and their respective officers, trustees, employees, agents, or representatives, arising out of or in connection with the administration, evaluation, recommendation, or selection of any bid or proposal; waiver of any requirements under the bid or proposal documents or contract documents; acceptance or rejection of any bid or proposal; and award of the contract.

The district guarantees no minimum dollar amount in purchase orders against this contract. The scope of this request and requirements of the District as shown in the specifications shall not be considered as binding on the District, and the work actually may be less than or greater than projected.

The RISD can terminate any resulting award for this request with thirty (30) calendar day notice, in the event no funds or insufficient funds are appropriated and budgeted or are otherwise not available in the next fiscal year for obligations herein provided, however, this provision shall not be construed so as to permit RISD to terminate this request in order to enter other contracts or make other arrangements for essentially the same services made the subject of this solicitation.

All bids and proposals from the vendor must remain open for acceptance for sixty (60) days after submittal.

AUTHORITY

The Board of Trustees has delegated to the superintendent the authority to make budgeted purchases for goods and services. Functional area experts, day-to-day contract administrators/managers, teachers, principals, and/or other district employees are not authorized to substantially amend this solicitation document or to substantially modify the subsequent contract. Substantially includes, but is not limited to, changes to delivery dates, place of delivery, and/or specifications that significantly alter the form, fit, and function of a product or the scope of work of a service. Amendments to solicitation documents may be made by the Director of Purchasing. Modifications to contracts/agreements will be made by the Director of Purchasing in accordance with the RISD Board of Trustee guidance, policies, and/or procedures. If a vendor acts on the guidance of a district employee that is not authorized to make changes, the vendor does so at his or her own risk or peril. Also, if a vendor attempts, or gains, a modification/amendment from a district employee that is not authorized to make changes, the vendor does this at his or her own risk or peril and risks the termination of his or her contract/agreement. The functional administrator for this contract is Tim Lyssy, Director of Project Planning and Construction.

CONTACT

Contact between soliciting vendors and user departments during this solicitation process or evaluation process is prohibited. Any attempt by a soliciting firm to contact the department may result in disqualification.

VENDOR QUESTIONS

Any explanation desired or questions by a vendor regarding the meaning or interpretation of these instructions or any other documents included in this solicitation must be requested in writing to RISD, Director of Purchasing, 1050 Williams Street, Rockwall, TX 75087 (jana.hunter@rockwallisd.org) with sufficient time allowed for a reply to reach vendors before the submission of their offers. The email subject line for questions should read: "Questions" followed by the solicitation number and title. The deadline for questions regarding this solicitation is March 13, 2026.

ADDENDA

Written responses to vendor questions shall be presented in the form of an Addendum and posted on the District's website at: https://www.rockwallisd.com/Page/380. Respondents should monitor the Purchasing page on the RISD website for such postings. Oral explanations or instructions will not be binding. Rockwall ISD reserves the right to post addendums up to, and including, the business day prior to the deadline. Vendors who submit a bid or proposal without acknowledging receipt of all addenda issued may be deemed to have submitted a bid or proposal not responsive to the solicitation. Failure to receive such addenda does not relieve the vendor from any obligation under the bid or proposal submitted. All formal written addenda become a part of the vendor bid or proposal documents.

PRE-BID MEETING

Any scheduled pre-bid meeting, will be noted on the cover page of this document. In the event a pre-bid meeting is held, attendance is highly recommended to all potential responders. The purpose of this meeting will be to answer any questions regarding the proposal specifications. Proposers are reminded, however, that verbal responses are not binding – only questions answered by formal written agenda will be binding and will be made part of the proposal documents. Proposers must satisfy themselves, upon examination of these specifications in the pre-bid conference, as to the intent of the specifications. After submission of the proposal, no complaint or claim that there was any misunderstanding in regard to items listed for proposal will be entertained from either party.

SUBMISSION

The responsibility for compliance with this solicitation and the subsequent contract shall be with the bidder/respondent. In submitting a response to this solicitation, respondent understands and agrees to be bound by the terms and conditions, provided in this document, which shall be incorporated into any future contracts, agreements, or purchase orders relating to any resulting agreement between the vendor and Rockwall ISD.

Submissions to this request are due by: March 31, 2026 – 2:30 P.M. (CST)

Responses must be plainly marked on the outside with the vendor's name and address and the solicitation number. A shipping label has been provided in this packet and its use is highly encouraged. Respondents are instructed to submit (1) one original hard copy (marked ORIGINAL) and (1) one additional hard copy.

Responses must be delivered in a sealed envelope or container and submitted to the Purchasing Department at the RISD Administration Building in sufficient time to be received and time-stamped on or before the published date and time shown within this document or on any subsequent addenda. No other published dates will be binding. Late submissions will not be accepted. Unsigned, unsealed, faxed or late responses will not be accepted. Rockwall ISD will not be responsible for mail delivered from the post office. No oral, telegraphic, telephonic, electronic mail or facsimile transmitted responses will be considered. RISD Purchasing personnel will be the official time keeper for all submissions.

Each vendor shall furnish the information required by the solicitation documents. Proposals should provide straightforward, concise information that satisfies the requirements of this solicitation. Emphasis should be placed on conformity to the instructions and requirements of this solicitation and the completeness and clarity of content. Links to web sites for supporting documentation are not acceptable. Expensive bindings, color displays, and advertising materials are not necessary or desired.

Offers submitted on other than authorized forms or with different terms or provisions may be considered to be non-responsive. The vendor must sign the Offer Form and return with the other certifications provided

herein. Failure to manually sign the offer may disqualify it from being considered. The person signing the documents must initial erasures or other changes. Signatures by an agent are to be accompanied with evidence of his authority unless such evidence has been previously furnished to RISD.

EXCEPTIONS/MODIFICATIONS/WITHDRAWAL

Responses deposited with Rockwall ISD may be withdrawn prior to the time set for opening. A response may not be withdrawn after the submittal deadline. By submitting a response, the proposer warrants and guarantees that the document has been carefully reviewed and checked and that it is in all things true and accurate and free of mistakes. If any exceptions are taken to any portion of the bid or proposal, the vendor must clearly indicate the exceptions taken and include a full explanation. Vendor's failure to identify exceptions or proposed changes will constitute acceptance by the vendor of the bid or proposal as proposed by the District. The District reserves the right to reject a bid or proposal containing exceptions, additions, qualifications, or conditions. Any bid or proposal to the District by the vendor, or contract between the District and the vendor, can be modified or withdrawn only by written agreement between Rockwall ISD and the vendor.

BID OPENING

Submittals may be publicly opened immediately after the response deadline on the same day. Responses received by hand delivery or mail after the stated due date and time will remain unopened. Trade secrets and confidential information contained in response shall not generally be open for public inspection, but RISD's records are a matter of public record.

DISQUALIFICATION

Any bid or proposal that does not contain all required contents required by District may be disqualified. Vendor is strongly encouraged to carefully review its bid or proposal documents prior to submitting their response to ensure all requirements are met. Failure to provide the information requested, in its entirety, may be grounds for disqualification of the bid or proposal. Bidders or proposers may also be disqualified and their bids or proposals not considered, among other reasons, for any of the following specific reasons:

a. Reason for believing collusion exists among respondents
b. Reasonable grounds for believing that any respondent is interested in more than one solicitation for the work contemplated
c. Where the respondent, any sub-contractor or supplier, or the surety on any bond given, or to be given, is in litigation with the District or where such litigation is contemplated or imminent, in the sole opinion of the District
d. Respondent being in arrears on any existing contract/purchase order or having defaulted or failed to perform in a satisfactory manner on a previous purchase order
e. Lack of competency as revealed by pertinent facts, including but not necessarily limited to, experience and equipment, financial statement and questionnaires

f. Uncompleted work that, in the judgement of the District, will prevent or hinder the prompt completion of addition work if awarded.
g. Where the bidder or proposer has failed to perform in a satisfactory manner on a previous purchase order or contract.

RISD expressly reserves the right to:

a. Reject any or all proposals
b. Consider a response irregular if it shows any omissions, alterations of form, additions, or conditions not called for; failure to return all forms and copies; or irregularities of any kind.
c. Waive any minor informality or deficiency in a bid or proposal if it is determined to be in the best interest of RISD
d. Award to a single vendor, multiple vendors, each line item separately, or in any combination it determines to be in the best interest of the District. If the Respondent chooses to propose "All or None" or is not agreeable to multiple or split awards, it must be noted as a deviation and included with the response.
e. Reissue a request
f. Consider and accept an alternate proposal as provided herein when most advantageous to RISD, including the utilization of other District contracts, contracts awarded by other governmental agencies, other school boards, or cooperative agreements in lieu of any offer received or award made as a result of this proposal, if it is in the best interest to do so.
g. Cancel the contract with a thirty-day written notice, without prejudice, for factors including, but not limited to, non-availability or non-appropriation of funds
h. Procure any item or services by other means to meet time-sensitive requirements
i. As part of the evaluation process, seek additional information from bidders or proposers, interview bidders or proposers, and negotiate the terms of a proposal as allowed by Texas law.
j. Negotiate price/delivery for service(s)/products(s) identified by this request. The District reserves the right to reject any and all bids that comply with the specifications or to accept a higher bid that complies, when, in judgment of the District, such proposal offers additional value or function, which justifies the difference in price.
k. Make an award without discussion with any proposer.
l. Be the sole judge of acceptable proposal responses.
m. Cancel part or this entire contract at any time during the term without cause. Notification will be submitted in writing no less than thirty (30) days prior to the effective date. Upon receipt of such notice from the District, vendor shall not thereafter incur, and RISD shall have no liability for, any costs under this solicitation that are not necessary for actual performance of the request between the date of the notice of termination for convenience and the effective date of that termination for convenience. In the event of a termination for convenience hereunder, RISD shall have no liability to vendor for lost or anticipated profit resulting there from.

n. Terminate for default all or any part of this contract if vendor breaches any of the terms hereof or if the vendor becomes insolvent or files any petition in bankruptcy. Such right of termination is in addition to and not in lieu of any other remedies which RISD may have in law or equity, specifically including, but not limited to, the right to collect for damages or demand specific performance. RISD may terminate the contract and debar the vendor for future "bidding" for violations of the federal requirements including, but not limited to, "Contract Work Hours and Safety Standards Act", "Equal Employment Opportunity Act", and "Energy Policy and Conservation Act".

Purchases of service or equipment from a business owned in whole or in part by a Rockwall ISD employee shall be permitted only when approved by the Director of Purchasing and when determination has been made that such equipment or service is not an extension of the employee's regular job responsibility at the District. Failure on part of Proposer to disclose ownership by the District employee may be grounds for disqualification.

EVALUATION

Proposals may be evaluated by an Evaluation Committee comprised of key Rockwall ISD personnel in order to fairly evaluate all qualified proposals. Evaluation by committee members will be combined into one score, which will be compared to the other proposals.

To the extent allowed by law, discussions/negotiations may be conducted with vendors who are deemed to be within the competitive range. If discussions/negotiations are conducted, respondents may be required to submit a best and final offer. The best and final offer may be required as early as 24 hours after completion of discussions/negotiations.

In determining to whom to award a contract and per the Texas Government Code 2269.055, the district will consider and apply any existing laws, including any criteria, related to historically underutilized business and any existing laws, rules or applicable municipal charters, including laws applicable to local governments, related to the use of women, minority, small, or disadvantaged business. The district may also consider the following criteria. At the discretion of the district and in evaluation of this solicitation, point values are indicated after each criteria item.

Govt. Code 2269	Criteria	Weight
(1)	The price	60
(2)	The offeror's experience and reputation	15
(3)	The quality of the offeror's goods or services	20
(4)	The offeror's proposed personnel	5
(5)	Any other relevant factor specifically listed in the request for bids, proposals or qualifications	

In determining an award of a contract under Texas Government Code 2269.055, the government entity shall:

a. Consider and apply any existing laws, including any criteria, related to historically underutilized businesses; and
b. Consider and apply any existing laws, rules, or applicable municipal charters, including laws applicable to local governments, related to the use of women, minority, small or disadvantaged business.

As provided by Texas Government Code 2269.054 ("Right to Work"), Rockwall ISD will not consider whether the vendor is a member of, or has any other relationship, with any organization, and the specifications are not intended to, and do not, deny or diminish the right of a person to work because of the person's membership or other relationship status with respect to any organizations.

It is the intent and policy of the District not to discriminate on the basis of sex, disability, race, color, or national origin in its programs and/or activities, nor in its employment practices.

LOBBYING

In order to ensure the integrity of the selection process, the vendor's employees, officers, agents, or other representatives shall not lobby or attempt to influence a vote or recommendation related to the vendor's response, directly or indirectly, through any contact with school board members or other district officials involved in the solicitation from the date it is released until the award.

AWARD

Successful vendor(s) may be notified in writing of District's award. No assignment of a bid, proposal, or resulting contract is permitted without the prior notice to and written consent of Rockwall ISD by means of a Notice to Proceed and/or Authorized Purchase Order or signed contract after a recommendation has been accepted by the RISD Board of Trustees. If respondent requires any other agreement, a draft document must be provided with the proposal. No work shall begin, goods procured or delivered, or costs incurred by vendor until the notice is received. Any cost incurred by the vendor prior to the notice shall not be reimbursed by the District.

Tabulations may be requested by contacting the Director of Purchasing via email upon award of a contract based upon approval by the RISD Board of Trustees, if required. Otherwise, information may be released after award of the contract by the Superintendent or designee.

TERM

If this solicitation is for a set time period only, or a single purchase, the award will last until the goods or services have been delivered, completed and accepted by the District. The District reserves the right to acquire reasonable amounts of additional goods/services, as listed in the bid or proposal, subject to verification of the same or lower prices and conditions of the bid or proposal and consistent with Texas law. After the initial contract term, the District reserves the right to extend the contract as indicated in this request.

PRICING

All prices proposed by the vendor, and accepted by the District, shall remain in effect throughout the term of the bid proposal, award, contract, or purchaser order, and cannot be increased during that term without written agreement between the vendor and the Rockwall ISD Board of Trustees or its designee. Rockwall ISD reserves the right to show a preference to any bid or proposal that provides a standard discount percentage for goods or services, or a discount for early payment of any bill to the vendor for its goods or services.

BILLING AND PAYMENTS

Per CH Local of District Policy - The District limits its purchases through the use of properly drawn and authorized purchase orders. Consequently, the District is not responsible for items not ordered via this method. The purchase order number shall appear on all itemized invoices to ensure payment. District employees shall not be permitted to purchase supplies or equipment for personal use through the District's business office without an authorized purchase order. Completing work or providing product without a purchase order may result in non-payment by the district and/or termination of awarded contract.

The District is a tax-exempt entity under Texas law. Vendor should not include tax on its bid, proposal, quote or invoice to the District. Vendor shall submit itemized invoices on each purchase order in a timely manner following delivery.

Invoices shall indicate the purchase order number and be submitted to RISD Business Office, Attn: Accounts Payable, 1050 Williams Street, Rockwall TX 75087 or emailed to accountspayable@rockwallisd.org.
The vendor shall make no charge or addition to the accepted price for delivering, placing, or invoicing product(s). Payment shall not be due until all items on the purchase order have been received by RISD (unless specified in the specifications) and the above instruments are submitted and the invoice has been accepted by RISD. All prices shall be F.O.B. destination.

District shall make all payments under this Agreement from current revenues available. In the event no funds,

or insufficient funds due to non-appropriation, are available at any time or during any fiscal period when such payment is due, in accordance with Local Government Code Ann. §271.903, District shall notify vendor of such occurrence and this Agreement shall terminate on the last day of the fiscal period for which payment was received without penalty or expense to District of any kind whatsoever. However, District shall be responsible to remit payment for all services provided by the Vendor to the District prior to the termination date.

GOODS

The vendor warrants that it owns and is legally able to transfer ownership of the goods or materials that are the basis of the solicitation to Rockwall ISD. The vendor warrants that it owns a clear title free of any materialman's, suppliers, or other type of liens, mortgage, encumbrance, or other security interest in the goods or materials supplied to Rockwall ISD. Any breach to this warranty of title shall be considered a default by the vendor and good cause for termination of the award, contract, or purchase order.

Strict conformance with the standards, specifications, and requirements of the bid or proposal is required by Rockwall ISD. Unless otherwise stated in the specifications, all supplies and components to be provided shall be new (not used or reconditioned, and not of such age or so deteriorated as to impair their usefulness or safety), of current production, and of the most suitable grade for the purpose intended. If at any time during the term of an awarded agreement the vendor believes the furnishings of supplies or components which are not new is necessary or desirable, it shall notify the District immediately, in writing, including the reasons and proposing any consideration which will flow to the District if authorization to use such supplies or components is granted.

If a brand name or specific model name is shown in the proposed specifications or bid form, such usage is to indicate an acceptable standard which must be considered if bidding better or equivalent products. Any bid or proposal for such better or equivalent products shall provide significant information on the products to allow the District to determine whether or not they are acceptable.

Any proposed substitution of goods or services to be supplied by the vendor shall require prior written acceptance by the District, unless stated otherwise. The vendor shall be bound to provide all proposed goods or services if its bid or proposal is accepted and awarded by Rockwall ISD, and no changes shall be acceptable unless agreed to in writing by the District.

Vendor assumes all liability for delivering non-compliant goods. The District reserves the right to reject any tender of non-compliant goods and shall require the vendor to take possession of such defective goods at no cost to District, and replace them with compliant goods at no cost to District, unless Rockwall ISD elects, in writing, to accept such non-compliant goods. Such non-confirming goods shall constitute good cause for termination of the contract, purchase order, or award, if not accepted by written agreement by Rockwall ISD or cured by the vendor.

Respondent agrees to ascertain whether goods manufactured in accordance with the specifications will give rise to the rightful claim of any third person by way of infringement or the like. If vendor is of the opinion that an infringement or the like will result, he/she will notify RISD to this effect in writing within two weeks after the signing of this a contract. If RISD does not receive notice and is subsequently held liable for the infringement or the like, vendor will indemnify RISD for any damages due to such claim. If vendor, in good faith, ascertains that production of the goods in accordance with the specifications will result in infringement or the like, this document shall be null and void. RISD may pay vendor for the reasonable cost (as determined by RISD) of his/her search as to infringements.

Respondent warrants that the product sold to RISD shall conform to the standards promulgated by the federal government including, but not limited to, the U.S. Department of Labor under the Occupational Safety and Health Act (OSHA) and the Consumer Product Safety Commission (CPSC). In the event the product does not conform to applicable safety standards, RISD may return the product for correction or replacements at the vendor's expense. In the event vendor fails to make the appropriate correction within a reasonable time (i.e., 2 weeks) correction may be made by RISD at vendor's expense.

The terms of the agreement are “no arrival, no sale”. The title and risk of loss of the goods shall not pass to the District until the District actually receives and takes possession of the goods/services at the point or points of delivery. The District shall have the right to inspect the goods at delivery before accepting them.

The vendor shall be responsible for replacing or correcting any defective product or service supplied to the District in response to the Solicitation at no cost to Rockwall ISD.

DELIVERY

Performance of service/delivery of goods shall be made to the location identified on each purchase order or resulting contract. All work performed, as herein shown under the specifications, shall be of the highest quality workmanship and shall in every respect meet or exceed the industry standards for this type of good/service. Every tender or delivery of goods must fully comply with all provisions of this contract as to time of delivery, quality and the like. All delivered equipment, materials or merchandise must be new, unused, free of liens, and in the manufacturer's original packing unless otherwise specified. If a tender is made which does not fully conform, this shall constitute a breach of the contract, purchase order, and award, and the vendor shall not have the right to substitute a conforming tender, provided, where the time for performance has not yet expired, the vendor may reasonably notify the district of his intention to cure and may then make a conforming tender within the contract time but not afterward.

The vendor will package goods in accordance with good commercial practice. Each shipping container shall be clearly and permanently packed as follows: (a) vendor’s name and address;(b) Consignee's name, address and purchase order or purchase release number and the supply agreement number if applicable; (c) Container number and total number of containers, e.g., box 1 of 4 boxes; and (d) the number of the

container bearing the packing slip. The vendor shall bear the costs of packaging and delivery at reasonable costs unless otherwise provided. Acceptance by the District of any delivery shall not relieve the vendor of any guarantee or warranty, express or implied, nor shall it be considered an acceptance of material not in accordance with the specifications and shall not waive the District's right to request replacement of defective material.

NOTICE OF DELAYS

Whenever the vendor encounters any difficulty which delays or threatens to delay timely performance, the vendor shall immediately give notice, in writing, to the District, including all relevant information. Such notice shall not in any way constitute a basis for an extension of the delivery or performance schedule or be construed as a waiver by Rockwall ISD of any right or remedies to which it is entitled by law or pursuant to provisions herein. Failure to give such notice, however, may be grounds for denial of any request for an extension of the delivery or performance schedule because of such delay.

SAFETY DATA SHEET (SDS)

The vendor shall provide, at no cost to DISTRICT, at least one (1) copy of any Safety Data Sheet (SDS) applicable to any goods or materials to be supplied by the vendor in response to this solicitation.

WARRANTIES

Warranties for goods and services shall be a minimum of one (1) year from completion of the bid or proposal. If goods or services to be provided are of comparable quality, the District may give preference to longer warranties when evaluating the bid or proposal.

The price to be paid by Rockwall ISD shall be that contained in vendor's response, which the vendor warrants to be no higher than the vendor's current prices on orders by others for products of the kind and specification covered by the agreement for similar quantities under similar or like conditions and methods of purchase. In the event the vendor breaches this warranty, the prices of the items shall be reduced to the vendor's current prices on orders by others or, in the alternative, Rockwall ISD may cancel this contract without liability to the vendor for breach or the vendor's actual expense.

The vendor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for commission, percentage, brokerage, or contingent fee excepting bona fide employees of bona fide established commercial or selling agencies maintained by the vendor for the purpose of securing business. For breach or violation of this warranty, Rockwall ISD shall have the right in addition to any other right or rights to cancel this contract without liability and to deduct from the contract price, or otherwise recover the full amount of such commission, percentage, brokerage or contingent fee.

The vendor shall not limit or exclude any implied warranties and any attempt to do so shall render this contract

voidable at the option of the District. The vendor warrants that the goods furnished will conform to the specifications, drawings and descriptions listed in the bid invitation and to the sample(s) furnished by the vendor, if any. In the event of a conflict between the specifications, drawings and descriptions, the specifications shall govern. All equipment items awarded as a result of the bid will be covered by an all parts and labor warranty, including any/all transportation charges, for a minimum period of one (1) year.

CONTRACTORS

Persons providing services on a project ("subcontractor" in Texas Labor Code 406.096) include all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity that furnishes persons to provide services on the project.

Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. Services do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

The proposer declares that in the event of the award of a contract to the undersigned to this offer will comply with the Immigration Reform & Control Act of 1986.

Respondents will provide their own tools/equipment required/expected of their craft/trade. The contractor is responsible for permits and fees required and compliance with all local, state, and federal rules, regulations, and statutes. The job site shall be in a clean, safe and orderly condition at all times. It shall be the contractor's responsibility to remove all debris, materials, and equipment from the job site upon completion of the work specified.

The contractor shall agree to waive all right of subrogation against the District, its officials, employees and volunteers for losses from work performed by contractor for the District.

The contractor shall hold the District harmless from and indemnify it against all liability, including attorney's fees, which may arise from and accrue directly from the performance of the work or any obligation of Contractor or failure of Contractor to perform any work or obligation provided for in this Agreement.

INSURANCE

The successful respondent, at his/her own expense, shall provide and maintain insurance with fiscally sound firms (at least an AM Best rating of A-) authorized to do business in Texas. Insurance requirements also apply to any sub-contractor(s) in the event that any work is sublet. The contractor is responsible for making

sure the sub-contractor(s) meets the minimum insurance requirement limits as by law.

Insurance must remain in effect for the duration of this contract. Should any policy be canceled before the expiration date, the issuing company will mail thirty (30) days written notice to the certificate holder, RISD. The contractor shall notify the district in writing by certified mail or personal delivery, within ten days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project. If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the district showing that coverage has been extended.

Vendor may be required to provide a copy of insurance coverage to RISD. If the district is to be named as an additional insured on the vendor's insurance coverage, the certificate indicating this should be provided within ten (10) calendar days from date of award. The bid/proposal number and title should be noted in the "Description of Operations/Locations/Vehicles/Special Items" block of the certificate and the "Certificate Holder" block of the certificate should read, "RISD, Attn: Director of Purchasing, 1050 Williams Street, Rockwall, TX 75087." Additional insurance requirements may be required for construction and/or services projects and will be identified elsewhere in this document.

The contractor represents to the district that all employees of the contractor who will provide services on the project will be covered by statutory workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code 401.011 (44) for all employees of the contractor, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

The contractor shall post on each project site a notice, in the text, form, and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project is required for the duration of the project. Duration of the project includes the time from the beginning of the work on the project until the project has been completed and accepted by the district.

The contractor shall retain all required certificates of coverage for the duration of the project and for one

year thereafter. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor that entitled the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

TERMINATION

Vendor shall be considered in default, and such default shall be grounds for the District to terminate any resulting award for this solicitation and/or pursue any and all relief, at law or in equity, to which it may be entitled by reason of such default, in the presence of a failure to perform any of its obligations under any resulting agreement and fails to correct such non-performance within ten (10) calendar days of written notice from the District to do so. In case of default of the vendor, RISD reserves the right to terminate the purchase order. In case of default of three (3) purchase orders, the district reserves the right to terminate the contract and suspend future business with the vendor.

Rockwall ISD shall have the right to terminate any purchase order to, contract with, or awarded to the vendor, in whole or in part, for cause (including breach of the proposal, warranties, or contract by the vendor**,** or because of loss of federal funding) or for the District's convenience at any time. Any award, contract, or purchase order is subject to termination by the District if any person significantly involved in initiating, negotiating, securing, drafting, or creating the solicitation on behalf of the District, is at any time while the solicitation is in effect, an employee of the vendor in any capacity or as a consultant to the District with respect to the subject matter of the Solicitation.

If deemed necessary, inspections will be made by authorized District personnel on a routine basis. Any deficiencies in the work performance disclosed during such inspections must be corrected following receipt of notification by the Vendor. Continued failure to take such corrective actions could, at the District's discretion, lead to termination of any resulting award.

FORCE MAJEURE

Neither the District nor the vendor shall be responsible or deemed to be in default of its obligations to the other to the extent any failure to perform or delay in performing its obligations under the bid or proposal is caused by events or conditions beyond the reasonable control of that party, and are not due to the negligence or willful misconduct of such party (hereinafter, "Force Majeure events"). For purposes of the bid or proposal, Force Majeure events shall include, but not be limited to, acts of God or public enemy, war, riot or civil commotion, strikes, epidemic, fire, earthquake, tornado, hurricane, flood, explosion, weather-related emergencies, or other catastrophes, or events or conditions due to law, regulations, ordinances, order of a court of competent jurisdiction, or executive decree or order. However, in the event of such delayed non-performance or nonperformance, the party so delayed shall furnish prompt written notice to the other party (including the date of inception of the Force Majeure event and the extent to which it will affect performance) and shall undertake all efforts reasonably possible to cure the delay or nonperformance and mitigate its effects, or to otherwise perform. The District shall not be responsible for payment for any product or service

delayed or foreclosed by any Force Majeure event unless and until such delayed or foreclosed product or service is provided. These provisions shall not preclude the District from canceling or terminating any resulting award (or any order for any goods or services included herein), or from revising the scope of the work, as otherwise permitted under the bid or proposal.

CONFLICTS

Effective January 1, 2006 and pursuant to Texas H.B. No. 914 and in accordance with Chapter 176 of the Texas Local Government Code, Section 176.006, any person or entity who contracts or seeks to contract with RISD for the sale or purchase of property, goods, or services (as well as agents of such persons, hereafter referred to as Vendors) are required to file, on an annual basis, a Conflict of Interest Questionnaire with the District. Each covered person or entity who seeks to or who contracts with RISD is responsible for complying with any applicable disclosure requirements. RISD will post the completed questionnaires on its website. Information regarding H.B. No. 914 may be obtained from the Texas Ethics Commission's website at http://www.ethics.state.tx.us.

Any board member who has any substantial interest, either direct or indirect, in any business entity seeking to contract with the District, shall, before any vote or decision on any matter involving the business entity, file an affidavit stating the nature and extent of interest and shall abstain from any participation in the matter. This is not required if the vote or decision will not have any special effect on the entity other than its effect on the public. However, if a majority of the governing body are also required to file, and do file similar affidavits, then the member is not required to abstain from further participation.
Local Government Code Chapter 171

In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 of the Government Code. The laws states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties (Form 1295) to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The business entity is responsible for first electronically filing Form 1295 with the Ethics Commission. This filing process creates a certification of filing and a completed Form 1295 must be printed, signed by an authorized agent of the business entity and submitted to the school district.

GRATUITIES

Please note that a "gift to a public servant" is a Class A misdemeanor offense if the recipient is a government employee who exercise some influences in the purchasing process of the governmental body. This would certainly apply to anyone who helps establish specifications or is involved in product selection or directs a purchase.

The District may, by written notice to the vendor, cancel this solicitation, its contract, purchase order, or award

without liability to the vendor if it is determined by the District that gratuities, in the form of entertainment, compensation, gifts, or otherwise were offered or given by the vendor, or any agent or representative of the vendor, to any Board of Trustee member, officer, or employee of the Rockwall Independent School District with an intent to secure favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performing of such an agreement. In the event this contract is canceled by the District pursuant to this provision, Rockwall ISD shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount used by the vendor to provide such gratuities.

FACILITIES

Rockwall ISD is a tobacco-free, drug-free, weapon-free and alcohol-free environment. No one may use, consume, carry, transport or exchange alcohol beverages, tobacco, cigarettes, electronic cigarettes, controlled substances and/ or illegal drugs while in a school district building or while on school district property. It is the responsibility of the vendor to ensure that its employees, agents, and subcontractors are not under the influence of drugs or alcohol and/or in possession of drugs, tobacco, alcohol, or weapons. If an employee, agent, or subcontractor of vendor is found to be under the influence and/or in possession of drugs/tobacco, alcohol, or weapons at the time of service, the vendor will be notified at once by District that the individual(s) must be immediately restricted from all Rockwall ISD campuses/departments. Repeated offenses by vendor could result in contract termination for default.

For the safety of students, all vendor personnel will sign visitor log in the office at the campus. An identification badge will be worn as required by the campus administrator. Vendor personnel are expected to maintain proper dress and exhibit a vendor badge or wear vendor issued shirts displaying the vendor logo. All contractors must also be in a uniform that identifies them at all times.

All vendor personnel are required to stay within the designated installation areas and may only enter a teacher's classroom when accompanied by District personnel.

At the time of offer submission, the person or entity submitting an offer must give notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in this conviction of a felony. The District may terminate a contract with a person or business if the District determines that the person or business failed to give such notice or misrepresented the conduct resulting in the conviction. This requirement does not apply to a publicly held corporation.

Texas Education Code Chapter 22 requires service contractors to obtain criminal history record information regarding covered employees and to certify to the District that they have done so. Covered employees with disqualifying convictions are prohibited from serving at a school district. Covered employees are all employees of a contractor who have or will have continuing duties related to the service to be performed at the District and have or will have direct contact with students. The District will be the final arbiter of what

constitutes direct contact with students.

Vendors (owners, officers, employees, volunteers, etc.) may not work on District property where students may or may not be present when they have charges pending, have been convicted, received probation or deferred adjudication for the following:

- Any offense against a child
- Any sex offense
- Any crimes against persons involving weapons or violence
- Any felony offense involving controlled substances
- Any felony offense against property
- Any other offense the District believes might compromise the safety of students, staff, or property.

ASBESTOS

Vendors who perform work inside the RISD facilities are hereby notified that buildings may contain asbestos containing materials. This notification is required by both the State of Texas Department of State Health Services and the Federal EPA Asbestos regulations. These guidelines cover both RISD's responsibilities and the Employer's responsibility to their employees. As a Vendor it is your responsibility to check each building prior to performing any work in that facility. These building materials may include but are not limited to: ceiling tile, floor tile and mastic, sheetrock, tape and bed compound, thermal pipe insulation, spray-on ceiling material, calks, and roofing products. As there have been numerous asbestos containing products manufactured over the years, you must check each building's Asbestos Management Plan. This plan is normally kept in the main office. Check with the school secretary and she will allow you to look at it. It is the vendor's responsibility to notify all employees working for them that RISD facilities may contain asbestos and where their employees may find the facility's Asbestos Management Plan.

Products and/or services procured under this agreement may be of a construction nature and will require certification that materials utilized and installed in conjunction with any project involving construction, be it new, renovation or contracted trade services, are free of asbestos and lead.

PUBLIC INFORMATION ACT (PIA) / FREEDOM OF INFORMATION ACT (FOIA)

By entering into a contract, pursuant to Texas Government Code Ann. Chapter 552, Subchapter J, the vendor agrees to be bound by the following terms if the contract has a stated expenditure of at least $1,000,000 for the purchase of goods or services by the District or if the contract results in the expenditure of at least $1,000,000 in public funds for the purchase of goods or services by the District in a fiscal year of the Rockwall ISD. If the district receives a written request for public information related to this Contract that is in the possession or custody of the vendor and not in the possession or custody of the District, Rockwall ISD shall send, not later than the third business day after the date the District receives the written request, a written request to the vendor that vendor provide that information to the District.

The vendor must:

- Preserve all contracting information related to the contract as provided by the records retention requirements applicable to the District for the duration of the contract;

- Promptly, within four business days, provide to the District any requested contracting information that is in the custody or possession of the vendor upon request of the Rockwall ISD; and,

On completion of the contract, either:

- Provide to the District at no cost all contracting information related to the contract that is in the custody or possession of the vendor; or

- Preserve the contracting information related to the contract as provided by the records retention requirements applicable to the District.

If the requirements of Subchapter J, Chapter 552, Texas Government Code Ann. apply to this Solicitation or Contract, the vendor agrees that the contract can be terminated if the vendor knowingly or intentionally fails to comply with the requirements of that subchapter. Texas Government Code Ann. Chapter 552.374.

Further, under Texas Government Code Ann. Chapter 552.372(c), Rockwall ISD may not accept a bid from or award a contract to an entity that the District has determined has knowingly or intentionally failed in a previous bid or contract to comply with Subchapter J, unless the District determines and documents that the entity has taken adequate steps to ensure future compliance.
If a vendor fails to provide the requested information to the District, Texas Government Code Ann. §552.373 requires the District to notify the vendor in writing of the failure and allow 10 business days to cure the violation. Rockwall ISD may terminate the contract if vendor fails to remedy the failure, the District determines the failure was knowing and intentional, and steps have not been taken to ensure future compliance.

INDEMNITY

Except as otherwise expressly provided or prohibited by law, respondent shall defend, indemnify, and hold RISD harmless from and against all claims, liability, loss and expenses, including reasonable costs, collection expenses, and attorneys' fees incurred, which arise by reason of the acts or omissions of respondent, its agents or employees in the performance of its obligations under this contract. This clause shall survive termination of this contract.

ANTI-TRUST

Successful respondent shall assign to RISD any and all claims for overcharges associated with this contract which arise under the antitrust laws of the United States, 15 USCA, Section 1 et seq., and which arise under

the antitrust laws of the State of Texas, Tex. Bus. & Com. Code, Section 15.01, et seq.

MEDIATION

In the event of any dispute arising out of, related to, or regarding vendor's bid or proposal, or charges for goods or services provided by the vendor, those disputes will be resolved under the terms of Texas Government Code Ann. Chapter 2251. The vendor further agrees that any dispute regarding the sufficiency of the goods or services supplied by the vendor that is not resolved by discussion with the District, will be submitted to mediation in Rockwall County, Texas, with a mutually-agreed mediator, before either party may file suit. The costs of the mediator will be divided equally between the parties. In the event of any litigation between the parties, the prevailing party shall be entitled to recover reasonable and necessary attorneys' fees from the other party.

LITIGATION

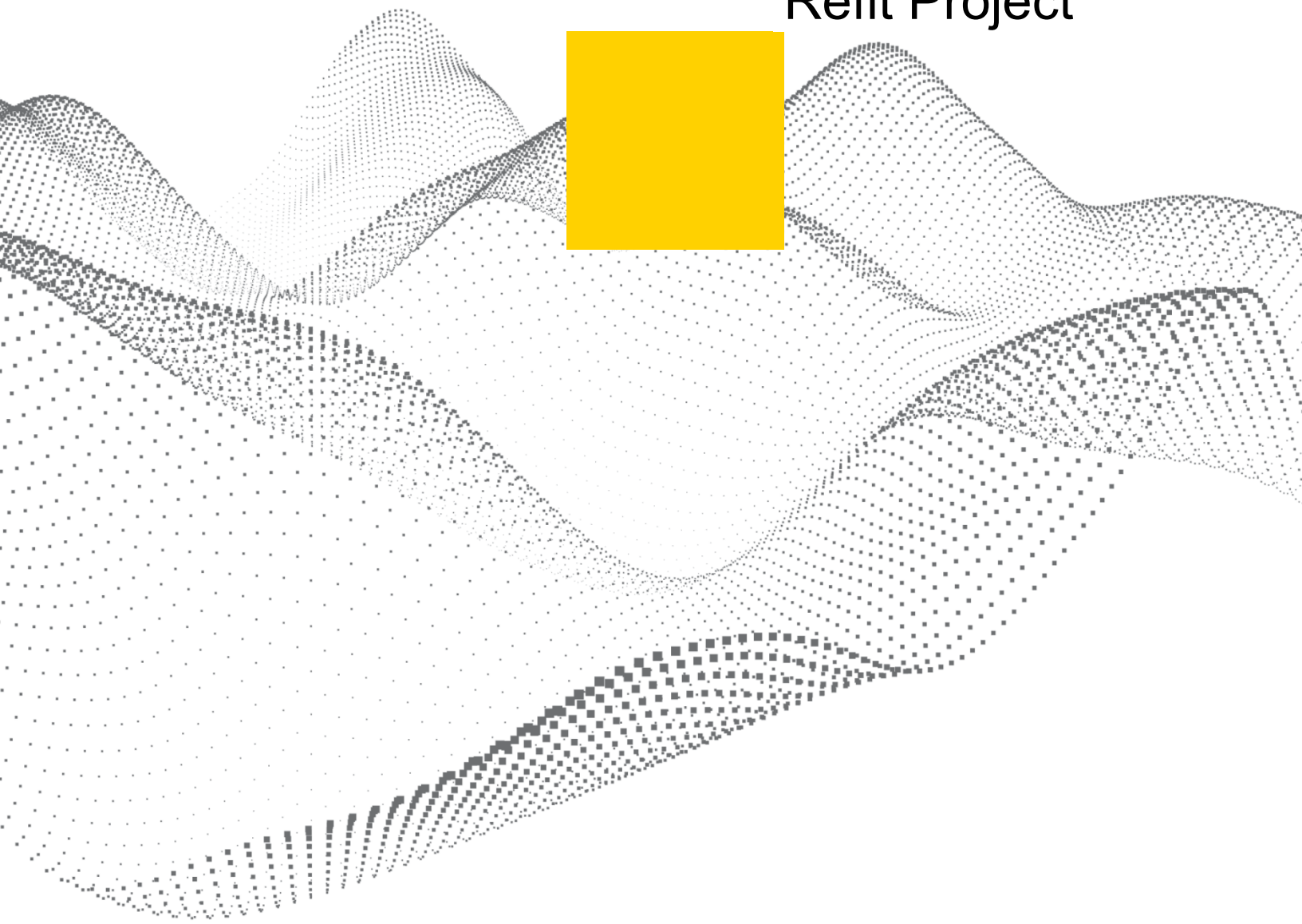
This procurement, and any resulting award, contract, purchase order, or other agreement arising out of or related to it, shall be governed and interpreted by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue shall be in Rockwall County, Texas, or, if no county is specified, then in the county in which the Owner's main administrative office is located.

SPECIFICATIONS

CORGAN

PROJECT MANUAL

Network Operations Center (NOC) HVAC Refit Project



Issue for Construction
26 February 2026
26003.0000

Corgan Associates, Inc.
401 North Houston Street
Dallas, Texas 75202
214 748 2000

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DOCUMENT 00 01 07

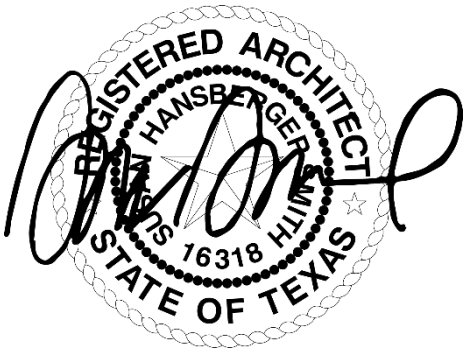
SEALS PAGE

Project Manual

Issue for Construction
26 February 2026
26003.0000

Network Operations Center (NOC) HVAC Refit Project

ARCHITECT OF RECORD
Corgan Associates, Inc.
401 North Houston Street
Dallas, Texas 75202
214 748 2000
Responsible for Sections marked with (CAI) in Document 00 01 10 "Table of Contents."



02/26/26
Architect of Record Date

MECHANICAL ENGINEER OF RECORD
Dunham Associates, Inc.
2100 Lakeside Boulevard, Suite 450
Richardson, Texas 75082
469 694 5700
Firm License #: F-1115
Responsible for Sections marked with (DAI-M) in Document 00 01 10 "Table of Contents."



02/26/26
Mechanical Engineer of Record Date

ELECTRICAL ENGINEER OF RECORD
Dunham Associates, Inc.
2100 Lakeside Boulevard, Suite 450
Richardson, Texas 75082
469 694 5700
Firm License #: F-1115
Responsible for Sections marked with (DAI-E) in Document 00 01 10 "Table of Contents."



02/26/26
Electrical Engineer of Record Date

END OF DOCUMENT

DOCUMENT 00 01 10

TABLE OF CONTENTS

CONTRACT DOCUMENTS PACKAGES

Issue for Construction 02/26/26

Designer Responsibility (DR): For DR codes, seals, and designer contact information; refer to Document 00 01 07 "Seals Page."

Division	Section Title	DR Code	Date
DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS			
00 01 01	Project Title Page		02/26/26
00 01 07	Seals Page		02/26/26
00 01 10	Table of Contents		02/26/26
00 73 43	Wage Rate Requirements		02/26/26
	Attachment: General Decision		02/26/26
DIVISION 01 — GENERAL REQUIREMENTS			
01 10 00	Summary	CAI	02/26/26
01 25 00	Substitution Procedures	CAI	02/26/26
	Attachment: Substitution Request Form	CAI	02/26/26
01 26 00	Contract Modification Procedures	CAI	02/26/26
01 29 00	Payment Procedures	CAI	02/26/26
01 31 00	Project Management and Coordination	CAI	02/26/26
01 32 00	Construction Progress Documentation	CAI	02/26/26
01 32 33	Photographic Documentation	CAI	02/26/26
01 33 00	Submittal Procedures	CAI	02/26/26
01 35 16	Alteration Project Procedures	CAI	02/26/26
01 40 00	Quality Requirements	CAI	02/26/26
01 41 00	Regulatory Requirements	CAI	02/26/26
01 42 00	References	CAI	02/26/26
01 50 00	Temporary Facilities and Controls	CAI	02/26/26
01 60 00	Product Requirements	CAI	02/26/26
01 73 00	Execution	CAI	02/26/26
01 77 00	Closeout Procedures	CAI	02/26/26
01 78 23	Operation and Maintenance Data	CAI	02/26/26
01 78 39	Project Record Documents	CAI	02/26/26
DIVISION 02 — EXISTING CONDITIONS			
02 41 19	Selective Demolition	CAI	02/26/26
DIVISION 08 — OPENINGS			
08 31 13	Access Doors and Frames	CAI	02/26/26
DIVISION 09 — FINISHES			
09 21 16	Gypsum Board Assemblies	CAI	02/26/26
09 91 23	Interior Painting	CAI	02/26/26

Division	Section Title	DR Code	Date
DIVISION 21 — FIRE SUPPRESSION			
21 05 00	Common Work Results For Fire Suppression	DAI-M	02/26/26
21 05 17	Sleeves and Sleeve Seals for Fire Suppression Piping	DAI-M	02/26/26
21 05 29	Hangers and Supports for Fire Suppression Piping and Equipment	DAI-M	02/26/26
21 05 53	Identification for Fire Suppression Piping and Equipment	DAI-M	02/26/26
21 13 00	Fire Suppression Sprinkler Systems	DAI-M	02/26/26
21 22 00	Clean-Agent Fire-Extinguishing System	DAI-M	02/26/26
DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING			
23 01 30	HVAC Air-Distribution System Cleaning	DAI-M	02/26/26
23 05 00	Common Work Results for HVAC	DAI-M	02/26/26
23 05 13	Common Motor Requirements for HVAC Equipment	DAI-M	02/26/26
23 05 29	Hangers and Supports for HVAC Piping and Equipment	DAI-M	02/26/26
23 05 53	Identification for HVAC Piping and Equipment	DAI-M	02/26/26
23 05 93	Testing, Adjusting, and Balancing of Systems	DAI-M	02/26/26
23 07 13	Duct Insulation	DAI-M	02/26/26
23 08 00	Commissioning of HVAC	DAI-M	02/26/26
23 09 13	Instrumentation and Control Devices for HVAC	DAI-M	02/26/26
23 09 23	Direct-Digital Control System for HVAC	DAI-M	02/26/26
23 09 34	Variable-Frequency Motor Controllers	DAI-M	02/26/26
23 11 23	Facility Natural-Gas Piping	DAI-M	02/26/26
23 31 00	HVAC Ducts	DAI-M	02/26/26
23 33 00	Air Duct Accessories	DAI-M	02/26/26
23 37 00	Air Outlets and Inlets	DAI-M	02/26/26
23 40 00	HVAC Air Cleaning Devices	DAI-M	02/26/26
23 74 16	Packaged Large Rooftop Air Handling Units	DAI-M	02/26/26
DIVISION 26 — ELECTRICAL			
26 05 00	Common Work Results for Electrical Communications and Security	DAI-E	02/26/26
26 05 05	Selective Demolition and Remodeling	DAI-E	02/26/26
26 05 09	Field Quality Acceptance Testing	DAI-E	02/26/26
26 05 10	Temporary Construction Lighting and Power	DAI-E	02/26/26
26 05 19	Low-Voltage Electrical Power Conductors and Cables	DAI-E	02/26/26
26 05 26	Grounding and Bonding for Electrical Systems	DAI-E	02/26/26
26 05 29	Hangers and Supports for Electrical Systems	DAI-E	02/26/26
26 05 33.13	Conduit for Electrical Systems	DAI-E	02/26/26
26 05 33.16	Boxes for Electrical Systems	DAI-E	02/26/26
26 05 33.23	Surface Raceways for Electrical Systems	DAI-E	02/26/26
26 05 53	Identification for Electrical Systems	DAI-E	02/26/26
26 05 73	Power System Studies	DAI-E	02/26/26
26 05 83	Wiring Connections	DAI-E	02/26/26
26 09 23	Lighting Control Devices	DAI-E	02/26/26
26 24 16	Panelboards	DAI-E	02/26/26
26 27 26	Wiring Devices	DAI-E	02/26/26
26 28 13	Fuses	DAI-E	02/26/26
26 28 16.13	Enclosed Circuit Breakers	DAI-E	02/26/26
26 28 16.16	Enclosed Switches	DAI-E	02/26/26
26 32 13	Engine Generators	DAI-E	02/26/26

Division	Section Title	DR Code	Date
26 43 00	Surge Protective Devices	DAI-E	02/26/26
26 51 00	Interior Lighting	DAI-E	02/26/26
DIVISION 28 — ELECTRONIC SAFETY AND SECURITY			
28 46 00	Fire Detection and Alarm	DAI-E	02/26/26

END OF DOCUMENT

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DOCUMENT 00 73 43

WAGE RATE REQUIREMENTS

1.1 FEDERAL PARTICIPATION DISCLOSURE

A. This project will be partially funded with Federal funds from the United States Department of Commerce, Economic Development Administration and therefore is subject to the Federal laws and regulations associated with that program.

1.2 DUTY TO PAY PREVAILING WAGE RATES

A. In compliance with Section 2258, Subchapter B of the Texas Government Code, Contractor shall pay not less than wage scale of various classes of labor as shown in the Attachment to this Document. The wage rates set forth are minimum rates only. Owner will not consider any claims for additional compensation made by any Contractor because the Contractor pays wages in excess of the applicable minimum rate stipulated in the Contract. The Attachment is not a representation that quantities of qualified labor adequate to perform the Work may be found locally at specified wage rates.

1.3 ATTACHMENT

A. The attached Document is part of the Procurement and Contracting Requirements for Project. They provide Owner's information and are made available for Bidders' convenience and information.

B. Attachment: Document 00 73 43.10 "General Decision" dated 01/02/2026.

END OF DOCUMENT

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GENERAL DECISION

General Decision Number: TX20260281 01/02/2026

Superseded General Decision Number: TX20250281

State: Texas

Construction Type: Building

Counties: Hunt, Kaufman and Rockwall Counties in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number	Publication Date
0	01/02/2026

ASBE0021-011 06/01/2025

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)	$ 33.23	7.52

BOIL0074-003 01/01/2025

	Rates	Fringes
BOILERMAKER	$ 33.17	24.92

CARP1421-002 10/01/2023

	Rates	Fringes
MILLWRIGHT	$ 32.02	11.27

ELEV0021-006 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC	$ 51.93	38.435+a+b

FOOTNOTES:
A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

B. New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Veterans Day.

ENGI0178-005 06/01/2020

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane	$ 32.85	13.10
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above	$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under	$ 32.35	13.10

IRON0263-005 06/01/2025

	Rates	Fringes
IRONWORKER (ORNAMENTAL AND STRUCTURAL)	$ 29.64	8.43

PLUM0100-005 11/01/2024

	Rates	Fringes
HVAC MECHANIC (HVAC Unit Installation Only)	$ 39.76	14.04
PIPEFITTER (Excludes HVAC Pipe Installation)	$ 39.76	14.04

SUTX2014-061 07/21/2014

	Rates	Fringes
BRICKLAYER	$ 19.89	0.00
CARPENTER, Excludes Drywall Hanging, Form Work, and Metal Stud Installation	$ 16.62	0.00
CAULKER	$ 15.16	0.00
CEMENT MASON/CONCRETE FINISHER	$ 13.21	0.00
DRYWALL HANGER AND METAL STUD INSTALLER	$ 15.42	0.00
ELECTRICIAN (Alarm		

Installation Only)	$ 20.93	3.86
ELECTRICIAN (Communication Technician Only)	$ 17.62	2.92
ELECTRICIAN (Low Voltage Wiring Only)	$ 17.97	2.63
ELECTRICIAN, Excludes Low Voltage Wiring and Installation of Alarms/Sound and Communication Systems	$ 20.65	3.05
FORM WORKER	$ 12.13	0.00
GLAZIER	$ 16.55	3.13
HIGHWAY/PARKING LOT STRIPING: Operator (Striping Machine)	$ 10.04	2.31
INSTALLER - SIDING (METAL/ALUMINUM/VINYL)	$ 14.74	0.00
INSTALLER - SIGN	$ 15.61	0.00
INSULATOR - BATT	$ 13.00	0.00
IRONWORKER, REINFORCING	$ 12.37	0.00
LABORER: Common or General	$ 11.25	0.00
LABORER: Mason Tender - Brick	$ 10.54	0.00
LABORER: Mason Tender - Cement/Concrete	$ 10.75	0.00
LABORER: Pipelayer	$ 13.00	0.35
LABORER: Plaster Tender	$ 12.22	0.00
LABORER: Roof Tearoff	$ 11.28	0.00
LABORER: Landscape and Irrigation	$ 11.09	0.00
LATHER	$ 16.00	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 12.83	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 13.93	0.00

OPERATOR: Bulldozer	$ 18.29	1.31
OPERATOR: Drill	$ 15.69	0.50
OPERATOR: Forklift	$ 13.21	0.81
OPERATOR: Grader/Blade	$ 12.96	0.00
OPERATOR: Loader	$ 13.46	0.85
OPERATOR: Mechanic	$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	$ 18.44	0.00
OPERATOR: Roller	$ 15.04	0.00
PAINTER (Brush, Roller and Spray), Excludes Drywall Finishing/Taping	$ 13.21	2.33
PAINTER: Drywall Finishing/Taping Only	$ 13.76	2.84
PLASTERER	$ 15.75	0.00
PLUMBER (HVAC Pipe Installation Only)	$ 22.16	5.46
PLUMBER, Excludes HVAC Pipe Installation	$ 22.31	5.18
ROOFER	$ 17.19	0.00
SHEET METAL WORKER (HVAC Duct Installation Only)	$ 20.88	5.19
SHEET METAL WORKER, Excludes HVAC Duct Installation	$ 24.88	5.97
SPRINKLER FITTER (Fire Sprinklers)	$ 22.94	0.00
TILE FINISHER	$ 11.22	0.00
TILE SETTER	$ 14.25	0.00
TRUCK DRIVER: 1/Single Axle Truck	$ 16.40	0.81
TRUCK DRIVER: Dump Truck	$ 12.39	1.18

TRUCK DRIVER: Flatbed Truck.....$ 19.65 8.57

TRUCK DRIVER: Semi-Trailer Truck.....$ 12.50 0.00

TRUCK DRIVER: Water Truck.....$ 12.00 4.11

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses

(29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to

davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

END OF ATTACHMENT

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project Information
2. Work covered by Contract Documents
3. Owner furnished products.
4. Contractor's use of premises and site.
5. Owner occupancy.
6. Work sequence.
7. Work restrictions.
8. Specification and drawing conventions.
9. Hazardous materials.

1.2 PROJECT INFORMATION

A. Project Information:

1. Project Identification: Network Operations Center (NOC) HVAC Refit Project for Rockwall ISD; 901 W Yellow Jacket Lane, Rockwall, Texas 75087.
2. Code Requirements: This project is governed by the Codes as indicated on the Drawings, with local amendments applicable to Rockwall, Texas. The Contractor shall comply with all requirements of the Codes and the Local Authority Having Jurisdiction.

B. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage as specified in Section 01 31 00 "Project Management and Coordination."

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Refit of Rockwall ISD's Network Operations Center.

B. Type of Contract:

1. Single Prime: Project will be constructed under a single prime (lump sum) contract.

2. Project is tax exempt. The Contract will be executed with separate contract sums for materials and services to comply with requirements of 1991 Texas House Bill 11.
3. Contract: Contract form provided by Owner.

C. Items noted "NIC" (Not in Contract) are provided by Owner.

1.4 OWNER FURNISHED PRODUCTS

A. Owner furnished items shall be as indicated on the Drawings as Owner Furnished Contractor Installed (OFCI) items.

B. Owner Responsibilities: Owner reserves the right to furnish certain products. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner furnished items according to Contractor's Construction Schedule.
3. Upon delivery, Owner and Contractor will inspect delivered items for damage. Assist Owner with inspection.

    a. If Owner furnished items are damaged, defective, or missing, Owner will arrange for replacement.

4. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
5. Owner will furnish Contractor a potential delivery date for Owner furnished products.

C. Contractor Responsibilities: Using Owner furnished delivery dates, incorporate delivery dates of Owner furnished items in Contractor's Construction Schedule.

1. Review Shop Drawings, Product Data, and Samples and return to Architect noting discrepancies or anticipated problems in use of product.
2. Receive, unload, and store Owner furnished items at site.
3. Upon delivery, inspect delivered items with owner for damage.
4. Protect Owner furnished items from damage during storage and handling, including damage from exposure to the elements.
5. If Owner furnished items are damaged as a result of Contractor's operations, repair or replace items.
6. Install and incorporate Owner furnished items into the Work.

1.5 CONTRACTOR'S USE OF PREMISES AND SITE

A. Unrestricted Use: Contractor shall have complete and exclusive use of immediate premises and site, with all exceptions as agreed to with the Owner. To the extent possible, limit use of site to areas within the Contract limits if so indicated. Do not

disturb portions of site beyond areas in which the Work is indicated and protect all items to remain from damage.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, entrances, fire exits or lanes, or delivery routes serving premises clear and available to Owner, Owner's employees, the public, and emergency vehicles. Do not use these areas for parking or for storage of materials.

    a. The Contractor shall protect all driveways, walkways and paving from damage during construction. Any damaged driveways, walkways and entrances shall be repaired by the Contractor at no additional cost to the Owner.

2. Coordinate use of premises under direction of Architect and Owner. Contractor shall be responsible for monitoring use of premises by employees and subcontractors.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions. Include length of service outages and intended scope of Work in all such notifications.
2. Obtain Owner's written permission before proceeding with utility interruptions.

C. Access routes for delivery of materials and equipment shall be as indicated on drawings by Contractor. Do not use access routes other than those indicated without permission of Owner and Architect.

D. Assume full responsibility for protection and safekeeping of products stored on project site, including but not limited to all salvaged items. Store materials and products in areas indicated for staging and protect from damage.

E. Move stored products, under Contractor's control, which interfere with operations of Owner or as required by Architect. Do not unnecessarily encumber project site with materials and equipment.

F. Store all salvaged items and protect from damage and weather conditions.

G. Staging and material storage shall be limited to areas indicated. Obtain specific permission from Owner for use of other areas for storage and staging.

H. Do not overload existing or new structures with weight that would compromise safety. Verify design loads for structure if necessary prior to loading structure.

I. Obtain and pay for use of additional secured storage or Work areas needed for operations, material storage for new and salvaged items.

J. Protect existing lawns, landscaping, sidewalks, pavements, curbs, and utilities subject to damage by Work under this Contract. Repair or replace existing Work damaged by

Contractor. Replace existing lawns damaged by Contractor's activities with hydromulched lawn seed to provide full stand of replacement grass.

K. Parking areas for Contractor's personnel shall be as indicated by Owner.

1.6 OWNER OCCUPANCY

A. Schedule construction operations for completion of portions of Work for any Owner's occupancy prior to Substantial Completion of entire Work.

B. Contractor agrees to the use and occupancy of portion of Project by Owner prior to Substantial Completion of entire Project, provided Owner:

1. Secures written consent of Contractor except when, in opinion of Architect, Contractor is chargeable with unwarranted delay in final completion of uncompleted items or other Contract requirements.
2. Secures endorsement from insurance carrier and consent of surety permitting partial occupancy of Project or use of Project during remaining period of construction.

C. Use and occupancy prior to Substantial Completion of entire Project does not relieve Contractor of responsibility to maintain specified insurance coverage on 100 percent basis for benefit of Owner, Contractor and subcontractors until Project is complete and accepted by Owner.

D. After Owner occupancy, allow following:

1. Access for Owner's personnel.
2. Operation of heating, ventilating, air-conditioning, and electrical systems.

E. During partial occupancy, mutually acceptable arrangements shall be negotiated between Owner and Contractor regarding warranties and insurance requirements respecting portion of Work affected by partial occupancy and regarding operation and cost of building services so that costs attributable to partial occupancy shall be borne by Owner and costs attributable to performance of Work shall be borne by Contractor.

F. Prior to occupancy, execute Certificate of Substantial Completion, designating areas to be occupied by Owner.

1.7 WORK SEQUENCE

A. Construct Work in phases to accommodate Work to be completed on schedule and as agree with Owner; coordinate construction schedule and operations with Owner's representative.

B. Construct Work to minimize public inconvenience. Do not close off public use travel paths until completion of one stage of construction will provide alternative usage.

C. Owner may require certain Work to be performed after normal Working hours or on holidays or weekends. Negotiate all such Work with Owner prior to final Agreement.

1.8 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated or required by the Authority Having Jurisdiction.

1. Weekend Hours: As permitted by Owner written authorization and in compliance with Local Ordinances.
2. Early Morning Hours: Comply with time restrictions set forth by the Local Authority Having Jurisdiction for restrictions.
3. Hours for Utility Shutdowns: Only during hours agreed to in writing by the Owner 2 weeks in advance.
4. Hours for Core Drilling or other noisy activity: During times unrestricted by the Owner and in accordance with Local Ordinances.

C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.

D. Restricted Substances and Firearms: Use of tobacco products and other controlled substances and firearms on Project site is not permitted.

E. Employee Identification: Owner may require identification tags for Contractor personnel Working on site. If so required, insure all personnel onsite use identification tags at all times.

F. Comply with all Work Restrictions imposed by the Local Authority.

G. Abide by all road cleaning and other requirements imposed by the Local Authority.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of the specification sections.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations and scheduled on Drawings.

PART 2 - PRODUCTS

2.1 HAZARDOUS MATERIALS - ASBESTOS

A. Owner requires that products and materials used meet the following requirements:

1. Contain not more than 1.0% of any kind or combination of asbestos, as determined by the Environmental Protection Agency (EPA) recommended test methods as listed in EPA/600R-93/116 July 1993 "Method for the Determination of Asbestos in Bulk Building Materials." This means one material component or a structure or layer of a material sample. Composite sample analysis is not allowed.

B. Contractor, by executing this Contract, accepts responsibility for prohibiting materials or products containing asbestos from being used on this Project.

C. Should Contractor furnish, use, or install products or materials containing asbestos, knowingly or otherwise, he has not met the requirements of this Contract.

2.2 HAZARDOUS MATERIALS – MOLD

A. If mold is present on the inside of the building; determine source of moisture and correct prior to performing the following:

1. Nonporous Surfaces: Mold growing on steel, aluminum or other nonporous materials may be cleaned using methods recommended by an Environmental Inspector licensed by the State of Texas.
2. Porous Surfaces: Entire mold contaminated surface must be removed and disposed of using methods recommended by an Environmental Inspector licensed by the State of Texas.
3. Following elimination of mold provide a report prepared by an Environmental Inspector licensed by the State of Texas that the building is free from mold contamination.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for substitutions.

1.2 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 Project requirements but may offer advantage to Contractor or Owner.

B. Comparable Products: Products demonstrated and approved through the product substitution process to have similar qualities related to type, function, dimension, in service performance, physical properties, appearance, and characteristics equivalent to or exceeding those of the specified product and incorporated into the Contract Documents.

C. Substitutions submitted and accepted prior to the award of the Contract for Construction are deemed part of the Contract Documents and are not subject to substitution requirements.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Identify the Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use facsimile of form provided in Form 01 25 00.10 "Substitution Request Form."
2. Documentation: Demonstrate compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating the reason the specified product, fabrication, or installation method cannot be provided, if applicable.
b. Coordination of 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.

c. Detailed comparison of significant qualities of proposed substitutions with those of the work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, physical characteristics, weight, size, durability, visual effect, noise levels, color and texture, vibration generation, interchangeability of parts or components, maintenance, compatibility with other materials, products, assemblies and components, equipment capacities and performance 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. Mark cut sheet to indicate specific model or product.
e. Samples, where applicable or requested.
f. Certificates and manufacturer/installer/fabricator qualification data, where applicable.
g. List of similar installations for completed projects, with project names and addresses as well as 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, from ICC-ES and local regulations.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions 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.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance During Bidding: Addenda.
b. Form of Rejection During Bid Period: No response.
c. Forms of Acceptance During Construction: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the work.

d. Form of Rejection During Construction: Written rejection on Substitution Request Form.

4. No response will be given for substitutions submitted by individual subcontractors or material suppliers.
5. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

B. Substitution requests are not allowed when disguised as a submittal. Request substitutions in accordance with substitution procedures. Substitutions submitted as a Submittal will be returned without review or comment.

1. Contractor assumes full and complete responsibility for installing substitutions that have not been formally submitted and approved by the Architect.

1.4 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.

1.5 COORDINATION

A. Revise or adjust affected work necessary to integrate work of the approved substitutions.

1.6 PRODUCT SUBSTITUTIONS

A. Conditions for Consideration: Substitution requests will be considered when the request is submitted in writing on the Request for Substitution form by the Contractor.

B. 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. 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 the 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.

1) A warranty based on the same warranty period only is not considered equivalent to the 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 each contractor involved.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60days after the Notice to Proceed. 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. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.

1) Additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has the necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the work.
h. Requested substitution has been coordinated with other portions of the work.
i. Requested substitution provides specified or better warranty.
j. 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.

D. Requests for substitutions will not be considered when:

1. Products are indicated or implied on Shop Drawings, Product Data Submittals, or Requests for Information (RFIs).

2. Requested directly by subcontractor or supplier.
3. Acceptance requires substantial revisions to Contract Documents or Contract time.
4. Additional cost to Owner is involved.
5. Substitute products shall not be ordered or installed without written acceptance of Architect. If proposed substitution is not accepted, provide specified product or materials.
6. Burden of proof for merits of proposed substitute is upon proposer. Architect's decision of acceptance or rejection of proposed substitution is final.
7. Review of Architect, acceptance, or failure to take exceptions to substitutions or other review documents, shall not relieve Contractor of its responsibility for compliance with performance or requirements of Contract Documents.
8. Contractor shall be responsible for and pay for all expenses incurred by Owner or Architect for changes to Contract Documents ultimately required by accepted Contractor requests for substitutions.

1.7 SUBMISSION PROCEDURES

A. Submit each product substitution as a separate request.

B. The burden of proof of compliance to requirements lies with the proposer.

C. Documentation: Submit supporting documentation indicating compliance with requirements for substitutions and the following:

1. Identify product by specification section and article numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.
2. Include a statement indicating the reason specified product is unavailable.

    a. Contractor’s failure to order specified product in sufficient time for delivery to site is not a valid reason for a substitution.

3. Coordination information, including list of modifications necessary for related work, existing conditions, and to construction performed by Owner and separate contractors necessary to accommodate proposed substitution.
4. Detailed comparison of significant properties of proposed substitution with quality of work specified. Significant properties may include but are not limited to attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated. Identify variations from contract requirements.
5. Detailed comparison of warranties of proposed substitution and specified product note variations.
6. Shop drawings and product data, including drawings and descriptions of products, fabrication and installation procedures, certified test results, and similar data.
7. Samples, where applicable or requested.
8. Indicate availability of product in quantities required and availability of approved/certified, trained, and skilled installers.

9. Indicate availability of maintenance services and replacement materials as applicable.
10. Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
11. ICC-ES Evaluation Reports evidencing compliance with building code.
12. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for work, including effect on overall Contract Time. If specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
13. Cost information, including proposal of change, if any, in Contract Sum.
14. Contractor's certification that proposed substitution complies with requirements of Contract Documents and is appropriate for applications indicated.
15. 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.
16. Contractor agreement to assume full responsibility for additional costs and time associated with substitution that may become necessary during the work.
17. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

D. Unsigned submittals are considered incomplete and will not be reviewed.

E. For accepted products, submit formal shop drawings, product data, and samples under provisions of Section 01 33 00 and the individual specification section.

1.8 ARCHITECT DUTIES

A. Architect will determine acceptability of proposed substitutions.

B. Review Contractor's requests for substitutions with reasonable promptness.

C. Notify Contractor, in writing, of decision to accept or reject requested substitution.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. Product Properties: Properties of substituted products considered include but are not limited to:

1. Physical dimension requirements to satisfy space limitations.
2. Static and dynamic weight limitations, structural properties.
3. Audible noise levels.
4. Vibration generation.
5. Interchangeability of parts or components.
6. Accessibility for maintenance, possible removal, or replacement.

7. Colors, textures and compatibility with other materials, products, assemblies, and components.
8. Equipment capacities and performance characteristics.
9. Warranty conditions.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REPRESENTATION

A. In making a formal request for substitution Contractor represents that:

1. It has thoroughly investigated proposed product and has determined it is equivalent to or superior in respects to that specified.
2. It will provide same warranties or bonds for substitution as for product specified.
3. It will coordinate installation of accepted substitution into the work and will make necessary changes for the work to be complete.
4. It waives claims for additional costs caused by the requested substitution which may subsequently become apparent.
5. Cost data is complete and includes related costs under the Contract, but not costs under separate contracts.

END OF SECTION

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SUBSTITUTION REQUEST FORM

To Architect: Corgan Associates, Inc.
Project Name: Network Operations Center (NOC) HVAC Refit Project

Specified Item: _____

Section	Page	Paragraph	Description

The undersigned Contractor requests consideration of the following:

Proposed Substitution: _____

1. Attached data includes product description, specifications, drawings, photographs, performance, and test data adequate for evaluation of the request; applicable portions of the data are clearly identified, both on the proposed substitution and the original specified product.
2. Attached data includes description of changes to Contract Documents, which proposed Substitution will require for its proper installation.

The undersigned Contractor states that the following paragraphs, unless modified on attachments, are correct.

1. The proposed substitution does not affect dimensions on Drawings.
2. The undersigned Contractor agrees to pay for changes to the building design, including architectural or engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution has no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts are locally available for the proposed substitution.

The Contractor further states that the function, appearance, and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The Contractor further warrants that the intent of specification Section 01 25 00, Article Contractor's Representation has been met.

1. Cost Reduction to the Owner: $ _____

ACCEPTANCES:

1. Contractor Acceptance: _____ Date: _____ Representing: _____
2. Owner Acceptance: _____ Date: _____ Representing: Rockwall ISD
3. Architect Acceptance: _____ Date: _____ Representing: Corgan Associates, Inc.

_____ Accepted as Noted _____ Received too late

_____ Not Accepted _____ Resubmit with complete documentation

END OF FORM

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

1.2 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, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the work that require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. 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.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. 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.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change 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 proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 . Construction Change Directive instructs Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

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.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction progress schedule.

1. Coordinate line items in the schedule of values with required administrative schedules and forms including:

    a. Construction Progress Schedule, in CPM or bar chart format.
    b. Application for Payment form.
    c. List of subcontractors.
    d. Schedule of alternates.
    e. List of products.
    f. List of principal suppliers and fabricators.
    g. Schedule of submittals.

2. Submit initial Schedule of Values to Architect within 14 days of Notice to Proceed.
3. Submit revised Schedule of Values at earliest possible date, but no later than minimum of 20 days before scheduled date of Initial Application for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Arrange Schedule of Values on 8-1/2 inches by 11 inches (213 mm by 283 mm) tabular form on white paper in format acceptable to Architect.
2. Use bar chart or CPM chart as guide to establish format; compile information based on completed tasks.

3. Project Identification:

    a. Project name and location.
    b. Name of Architect.
    c. Project number.
    d. Contractor's name and address.
    e. Date of submittal.
    f. Owner's contract designation.

4. Provide columns to indicate following for each item listed:

    a. Generic name.
    b. Specific task description.
    c. Change Orders numbers that have affected value.
    d. Dollar value.
    e. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

5. Follow table of contents of Project Manual as format for listing component items; identify each line item with number and title of respective specification section.
6. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
7. Break principal subcontract amounts down into multiple line items by completed task in various locations.
8. For each major line item, list subvalues of major products or operations under item.
9. Round amounts off to nearest whole dollar, total of listed values shall equal total Contract Sum.
10. For each part of work where Application for Payment includes materials or equipment purchased, fabricated, and stored, but not yet installed, include separate line items on Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of work.

C. Margins of Cost:

1. Indicate line items for indirect costs, and margins on actual costs, to the extent that each item is listed individually in Applications for Payment.
2. Each item in Schedule of Values and Application for Payment shall be complete, including its total cost and proportionate share of general overhead and profit margin.
3. At Contractor's option, temporary facilities and other major cost items that are not direct costs of actual work in place may be shown as separate line items in Schedule of Values.
4. Furnish line item cost for each of following general cost items:

    a. Bonds.
    b. Insurance.
    c. Field supervision and layout.
    d. Temporary facilities and controls.
    e. Testing.

D. Resubmittal:

1. After review by Architect, revise and resubmit schedule as necessary.
2. Resubmit revised schedule monthly in same manner.

E. Subschedule of Unit Material Values:

1. Submit subschedule of unit costs and quantities for following:

a. Submit subschedule for each separate stage of work specified in Section 01 10 00 "Summary."
b. Products on which progress payments will be requested for stored products.

2. Form and Content:

a. Form of submittal shall parallel that of Schedule of Values, with each item identified same as line item in Schedule of Values.
b. Unit quantity for bulk materials shall include an allowance for normal waste.

3. Unit values for materials shall be broken down as follows:

a. Cost of material, delivered and unloaded at Project Site, with taxes paid.
b. Installation costs, including overhead and profit.

4. Installed unit value multiplied by quantity listed shall equal cost of that item in Schedule of Values.
5. After review by Architect, revise and resubmit subschedules as necessary.
6. Resubmit revised subschedules monthly in same manner.

F. Upon request of Architect, provide support values with data which substantiate correctness.

1.4 APPLICATIONS FOR PAYMENT

A. Progress payments shall be made as work proceeds at intervals stated in the Agreement.

B. Work covered by Progress Payments shall, at time of payment, become property of Owner.

C. Form of Application for Payment will be notarized AIA Document G702 Application and Certification for Payment, supported by AIA Document G703 Continuation Sheet, submitted in quadruplicate.

D. Within 15 days of execution of Owner -Contractor Agreement, submit proposed sample of Lien Waiver and Bills Paid Affidavit forms for review and acceptance by Architect.

E. Conditions governing regular schedule for applications, payment, and retainage are stated in Contract.

F. Monthly Applications for Payment include Waivers of Liens for work included in previous months' Application for Payment. Waiver of Liens for subcontractors and materialmen shall be total amount paid prior to previous month's Application for Payment.

G. With each Application for Payment, certify that Application for Payment represents just estimate of cost reimbursable to Contractor under terms of Contract, and shall certify that there are no Mechanics' or Materialmens' Liens outstanding at date of Application for Payment, that due and payable bills with respect to work have been paid to date or shall be paid from proceeds of Application for Payment, and that there is no known basis for filing of Mechanics' or Materialmens' Liens against surety in connection with work, and that Waivers and Bills Paid Affidavit forms from subcontractors and materialmen have been, or will be, obtained in form specified in Contract.

H. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

I. Preparation of Application:

1. Format and Data Required:

a. Submit itemized applications on AIA Document G702 - Application and Certification for Payment Form, with AIA Document G703 Continuation Forms.
b. Provide itemized data on continuation sheets with format, schedules, line items, and values stipulated in Schedule of Values and acceptable to Architect.

2. Application Form:

a. Fill in required information, including Change Orders executed prior to date of submittal of applications.
b. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
c. Execute certification with signature of responsible officer of Contract firm.

3. Continuation Sheets:

a. Fill in total list of scheduled component items of work with item number and scheduled dollar value for each item.
b. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
c. Round off values to nearest dollar or as specified for Schedule of Values.
d. List each Change Order executed prior to date of submission at end of continuation sheets.
e. List by Change Order number and description as for original component item of work.

4. Initial (First) Application for Payment:

    a. Within 15 days of execution of Owner-Contractor Agreement. submit proposed sample of Lien Waiver and Bills Paid Affidavit forms for review and acceptance by Owner for use.
    b. Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include, but are not limited to, the following:

        1) List of subcontractors, with indications of MBE or WBE Owner firms.
        2) List of principal suppliers and fabricators.
        3) Schedule of Values.
        4) Contractor's Construction Schedule (preliminary if not final).
        5) Submittal Schedule (preliminary if not final).
        6) Copies of building permits.
        7) Copies of authorizations and licenses from governing authorities for performance of Work.
        8) Initial progress report.
        9) Report of Preconstruction meeting.
        10) Certificates of Insurance and insurance policies.
        11) Additional items as required in General Conditions.

J. Typical Monthly Application for Payment:

1. Each Application for Payment shall be consistent with previous Applications for Payments reviewed by Architect and paid by Owner.
2. Review pencil copy of Application for Payment with Architect at last scheduled job meeting each month, or at other agreeable time as can be scheduled.
3. Submit monthly Application for Payment on 15th day of each month.
4. Period of construction work covered by each Application for Payment is period ending 15 days prior to date for each progress payment and starting day following end of proceeding period.
5. Work covered by Progress Payments shall, at time of payment, become property of Owner.
6. Form of Application for Payment will be on specified forms, submitted in quadruplicate.
7. Complete each entry on forms, including notarization and execution by person authorized to sign legal documents on behalf of Contractor.
8. Incomplete Applications for Payment will be returned without action.
9. Entries shall match data of Schedule of Values and Contractor's Construction Schedule.
10. Use updated schedules if revisions have been made.
11. Include amounts of Change Orders and Construction Change Directives issued prior to last day of construction period covered by application.
12. Transmit executed copies of each Application for Payment to Architect by means ensuring receipt within 24 hours.
13. Transmit each copy with complete transmittal form listing attachments, and recording appropriate information related to Application in acceptable manner.
14. Stored Materials: Include amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

a. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
b. Provide supporting documentation that verifies amount requested, including paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
c. Provide summary documentation for stored materials indicating the following:

1) Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
2) Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
3) Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

15. Waiver of Liens:

a. With each Application for Payment, submit waivers of mechanics liens from each contractor, subcontractor and materialman who may be lawfully entitled to file mechanics lien arising out of Contract, and related to Work covered by payment application.
b. Submit waivers of lien on forms acceptable to Architect.
c. Waiver of liens shall be total paid prior to previous month's Application for Payment.

16. With each Application for Payment, Contractor certifies the following:

a. Application for Payment represents just estimate of cost reimbursable to Contractor under terms of Contract.
b. That there are no Mechanics' or Materialmens' Liens outstanding at date of this Application for Payment.
c. That due and payable bills with respect to the Work have been paid to date or shall be paid from proceeds of that Application for Payment.
d. That there is no known basis for filing of Mechanics' or Materialmens' Liens against surety in connection with Work, and that Waivers and Bills Paid Affidavit forms from subcontractors and materialmen have been, or will be, obtained in form specified in Contract.

17. Progress payments will be made in accordance with General Conditions.

K. Application for Payment at Substantial Completion:

1. Following issuance of Certificate of Substantial Completion, submit Application for Payment with following administrative actions and submittals that must precede or coincide with application:
2. Training of Owner's personnel.
3. Occupancy permits and similar required approvals.
4. Warranties and maintenance agreements.
5. Test, adjust, and balance records.

6. Maintenance instructions.
7. Start-up performance reports.
8. Change-over information related to Owner's occupancy, use, operation, and maintenance.
9. Final cleaning.
10. Application for reduction of retainage, and Consent of Surety.
11. Advise on shifting insurance coverage.
12. Final progress photographs.
13. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
14. Transmittal of required Project construction records to Owner.
15. Removal of temporary facilities and services.
16. Removal of surplus materials, rubbish, and similar elements.
17. Additional items as required by General Conditions.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Request for Information (RFI).
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1. Typically, a Contractor initiated written instrument relating to the execute of the work for additional information or clarification of the contract documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, in web based Project software directory, and in prominent location in built facility. Keep list current.

1.4 COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on Drawings. Specifically note dimensions that conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling, wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, including dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.

c. Fire rated enclosures around ductwork.

7. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire Protection System: Show locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not prepared in sufficient scope or detail, or are deficient, Architect will inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Submittal Format: Submit or post coordination drawing files using PDF format.

1.6 REQUEST FOR INFORMATION (RFI)

A. Upon discovery of the need for additional information, clarification, or interpretation of the Contract Documents, prepare and submit an RFI using the attached form.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs promptly to avoid delays in Contractor's work or work of subcontractors.
3. Submission of an RFI constitutes representation that the Contractor requires additional information regarding the Contract Documents after having made careful study and comparison of the Contract Documents, field conditions, Owner provided information, Contractor prepared coordination drawings, and prior project correspondence or documentation.

a. No response will be made to requests where the information is conveyed or contained in the Contract Documents or the Contractor’s own documents.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 .

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven workdays for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following workday.

1. The following Contractor generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web based Project software. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Autodesk Revit.
4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.

a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

5. The following digital data files will be furnished for each appropriate discipline:

a. Floor plans.
b. Reflected ceiling plans.

B. Web Based Project Software: Use Architect's web based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and parties involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 workdays prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.

n. Preparation of Record Documents.
o. Use of the premises and existing building.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

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 of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the activity under consideration, including requirements for the following:

a. 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. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.

v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. 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.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web based Project software site data files.
d. Submittal of written warranties.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, contractor, subcontractor, supplier, and other entity concerned with current progress or

involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of Proposal Requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of RFIs.
        14) Proposal Requests.
        15) Change Orders.
        16) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

G. Preapplication Roofing Conference: Not less than seven days or more than 21 days prior to scheduled commencement of roofing application, convene a preapplication roofing conference at project site.

1. Attendance is required by Architect, Contractor, roofing installer, roof consultant, and each entity required to coordinate with or to protect work.

2. Minimum Agenda:

    a. Review accepted Submittals.
    b. Review outstanding material problems.
    c. Review minutes of Preliminary Roofing Conference.
    d. Discuss installation schedules and sequence, and revisions that have occurred.
    e. Review equipment set up and on site storage.
    f. Review readiness of deck for application:

        1) Certification in place.
        2) Examination of substrate by those in attendance.
        3) Drains installed.
        4) Curbs, nailers, penetrations, perimeter, equipment.

    g. Review the installation of the roofing system; review requirements.
    h. Review weather and working conditions, and procedures for daily or inclement weather cut-offs.
    i. Review protection requirements after installation.
    j. Review testing requirements and procedures involved.
    k. Discuss requirements for warranties and bonds.
    l. Conduct tour of roof deck to review potential issues and to verify readiness.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for schedules and reports required for proper performance of the work.

1.2 REFERENCES

A. The Associated General Contractors of America (AGC): The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry.

1.3 QUALITY ASSURANCE

A. Scheduler: Submit documentation of Contractor's personnel specializing in CPM scheduling with five years minimum experience in scheduling construction work of complexity comparable to Project and having use of computer facilities capable of delivering readout within 24 hours.

B. Contractor's Administrative Personnel: Submit documentation of five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.4 DESCRIPTION

A. Provide information and input required for development of Project Schedule in accordance with requirements of this Section. Purpose of schedule is:

1. Assure adequate planning, scheduling, and reporting during execution of work by Contractor.
2. Assure coordination of work of Contractor and various subcontractors and subsubcontractors.
3. Assist Contractor and Owner in monitoring progress of work and evaluating proposed changes to Contract and Project Schedule.
4. Assist Owner and Contractor in preparation and evaluation of Contractor's monthly progress payments.

B. Use Critical Path Method (CPM) for planning, scheduling, and reporting work performed under Contract. Display graphic portions of Project Schedule by Activity-on-Arrow Diagramming Method (ADM).

1. Include Preliminary Network, Detailed Network, and computer produced Schedule and Cost Reports.

C. Provide Preliminary Network to monitor progress of work during development and acceptance of Detailed Network.

D. Contractor and major subcontractors shall meet with Owner within seven calendar days after date of Notice-to-Proceed to conduct joint review of Project Schedule requirements to assure mutual understanding by parties involved.

1.5 INITIAL SCHEDULE DEVELOPMENT (FORMAT)

A. Propose Critical Path Method arrow diagram format consisting of project activities, sequences and duration, submittals, procurement, and completion of work.

B. Submit to Architect from each major subcontractor letter confirming work schedule for their individual trade.

C. Submit initial network analysis schedule development within seven days of Notice to Proceed, or at Preconstruction Scheduling Meeting, to Architect for review.

D. Incorporate revisions deemed necessary by Architect and resubmit within additional 7 days.

E. Upon acceptance of network analysis format, begin data input and development of Preliminary Network.

1.6 PRELIMINARY NETWORK DEVELOPMENT

A. After acceptance of initial schedule format by Architect, Contractor to submit to Architect Preliminary Network within 14 calendar days of acceptance of schedule format, but not more than 21 days after Notice-to-Proceed. Submit four copies of Preliminary Network neatly organized and drawn non-time scaled from left to right on either 24 inches by 36 inches (610 mm by 915 mm) or 30 inches by 42 inches (563 mm by 1065 mm) standard size sheets with suitable notation relating interface points among sheets. Cover following project phases and activities:

1. Proposed procurement activities, including shop drawings, product data and sample submittals, and fabrication and delivery of critical and long lead time procurements.

    a. Indicate intended submittal dates and realistic delivery dates for fabrication and delivery items.
    b. Incorporated into Detailed Network (described below), including requested revisions.

2. Proposed construction activities to be accomplished during first 90 calendar days of Contract.

    a. Activity durations shall be in units of whole workdays and shall be limited to maximum 15 workdays for each activity.

b. Incorporate proposed 90 calendar day construction activities into Detailed Network, including requested revisions.

3. Include in proposed procurement and construction activities same information required for Detailed Network described below.
4. Summary activities not included above which are necessary to properly indicate following:

a. Approach to scheduling remaining work areas or phases of work. Represent work for each phase or area by at least one summary activity such that they cumulatively indicate entire Project Schedule.
b. Show approximate cost and duration for each summary activity on Preliminary Network and include best estimate of work.

B. Show sequence and interdependence of activities subject to requirements of other provisions of this Section.

C. Preliminary Network shall be basis for progress payments during first 90 calendar days of Contract while Detailed Network (described below) is being developed and accepted.

D. Updated on monthly basis while Detailed Network is being developed. Monthly updating of Preliminary Network shall be consistent with procedures and requirements for Schedule Updating, except computer produced Schedule and Cost Reports shall not become part of Project Schedule until after acceptance of Detailed Network.

E. Use as follows for time extension analysis during first 90 calendar days of Contract:

1. When Change Orders (and Proposed Changes) are initiated, delays are experienced, or Contractor desires to revise Preliminary Network, submit to Architect written Time Impact Analysis as required below, except included activities and event times in Analysis from current Preliminary Network update.
2. Determine final determination with regard to extent of time extension allowed in accordance with requirements for Time Impact Analysis, subsequent to development, review and acceptance of Detailed Network.

F. Within seven calendar days of Architect's receipt of Preliminary Network, Architect shall notify Contractor of concerns in regard to Preliminary Network. Furnish written response to Architect's comments prior to or concurrent with submittal of Detailed Network. Resolve comments and concerns before consideration of Detailed Network can commence.

1.7 DETAILED NETWORK DEVELOPMENT

A. Schedule development by Contractor: Within 28 days after Notice-to-Proceed, submit proposed Detailed Network to Architect. Cover entire Contract Time period and incorporate in detail first 90 calendar days of Preliminary Network, including requested revisions. Organize and drawn non-time scaled from left to right on either 24 inches by 36 inches (610 mm by 915 mm) or 30 inches by 42 inches (563 mm by 1065 mm)

standard size sheets with suitable notation relating interface points among sheets. Detailed Network shall include, but not be limited by, following as minimum:

1. Proposed procurement activities, including activities and information used in Preliminary Network. Recommended sequence would be as follows:

Duration	Description
---- --00	0 (restraint from NTP)
--00	--02-SUB
--02	--04-APP
--04	--06-F/D
--06	--081ARR
--08	----0 (restraint to installation)

   a. In above sequence, activity --00 --02 is submittal activity which precedes --02 --04, "approval." Activity --04 --06 is fabrication and delivery time which precedes --06 --08, "arrival." Begin each activity description with three character verb abbreviation standard in procurement item scheduling for purposes of computer report selection. Arrival activity, "ARR," is included for purpose of pinpointing cashflow. Load arrival activity with amount due contractor upon delivery of line item in question. Each activity of this type shall have "duration" of one day.

2. Proposed construction activities, including activities and information used in Preliminary Network. Develop construction sequencing separately from procurement. Construction activity sequence shall appear as though it were developed under assumption that materials are immediately available to Project. Link procurement activities grouped together on network diagram (preferably above construction logic), to various installation activities by restraints (dummies) from "J" nodes of "arrival" activities.
3. Proposed durations for construction activities.
4. Proposed sequencing of construction activities.
5. Proposed activity manpower, cost and equipment loading.

B. Depict following for each activity:

1. "I" and "J" (beginning and ending) event nodes and numbers, respectively. Utilize numerical designations to identify each and every event node. Do not utilize alpha-numeric event node numbering. Each "J" node number shall be larger than preceding "I" node numbers.
2. Concise description of Work represented by activity. As requested by Architect, either prior or subsequent to acceptance of Detailed Network, provide graphic explanation of relationship of activities in comparison with work areas identified on prints of Contract Documents, at no additional cost to Owner.
3. Activity duration in whole workdays, with maximum 15 workdays each, unless otherwise directed by Architect, except for nonconstruction activities such as procurement and fabrication of materials, delivery of materials, and curing of concrete. When single activity requires more than 15 days, subdivided into identifiable elements of less than 15 workdays each.

4. Performance responsibility by discipline code: MECH, ELEC, or acceptable abbreviations accepted by Architect.
5. Assigned dollar value (cost loading) of each activity of Detailed Network, which cumulatively equal total Contract Sum. Mobilization, bond and insurance costs may be shown separately. Prorate other General Requirement costs, overhead, and profit throughout activities. For this purpose, assume rate of activity value installation into work as linear with time.
6. Manpower loading of each activity. Prepare and submit (separate) manpower summary analysis in graphic format depicting manpower by principle trades and aggregate. Graph(s) shall show number of man days of effort, by month, over duration of Project Schedule.
7. Assignment to applicable activities of Detailed Network of major construction equipment to be utilized by Contractor, subcontractors, and sub-subcontractors in executing work.

C. Computer Printout:

1. Early Start and Early Finish dates.
2. Late Start and Late Finish dates.
3. Activity Float Time.
4. Actual Start and Finish dates.

D. Clearly identify activities illustrating accomplishment of time(s) for completion of project set forth in Contract. If schedule indicated earlier completion time(s) than that set forth in Contract, show float (or slack) between schedule and Contract dates on computer printout shall be part of total float available.

E. Produce computer printouts sorts and summaries, providing sorts and breakdowns as follows:

1. I-J.
2. Total float.
3. Performing organization.
4. Early start date.
5. Schedule of Values.
6. Monthly cash flow.

F. Develop network diagram logic so that no activity having duration greater than zero shall share I-node or J-node designation with other activities having duration greater than zero. There shall be no converging or diverging logic patterns involving more than one activity of duration greater than zero.

1. Include contractor and subcontractor work at tiers.

G. Show sequence and interdependence of activities required for complete performance of Work in logical sequence and coordinated plan of work.

H. Estimate proposed durations assigned to each activity of time required to complete activity considering scope and resources planned for activity. Upon request by

Architect, furnish written description of determination of each duration of critical activities. Include in request:

1. Explain number of crews, crew composition, number of shifts per day, number of hours in shift, and number of workdays per week.
2. Provide major item list of construction equipment for activity, including types, number of units, unit capacities, and proposed time each piece of equipment will be on job keyed to activities on which equipment will be used.
3. Other pertinent data affecting specific activity duration.

I. Failure by Contractor to include elements of work required for performance of Contract shall not excuse Contractor form completing work within Contract Time, regardless of acceptance of Detailed Network.

J. Unless noted otherwise in the Supplementary General Conditions, account for the following seasonal precipitation days for exterior Work.

1. DFW Region:

Month	Workdays
January	4
February	5
March	5
April	5
May	8
June	5
July	3
August	4
September	4
October	5
November	4
December	4
Total.	55

2. Show that critical activity path has been delayed by loss of days in excess of number indicated above before consideration of extension will be given.
3. In execution of interior work, show to satisfaction of Architect that interior work has been delayed by adverse weather in excess of number of allowable days above.

K. Indicate holidays, vacations and non-workdays applicable to schedule.

L. If Architect questions Contractor's proposed logic, durations, manpower, cost or equipment loading, within seven calendar days of receipt of written request, furnish satisfactory revision or adequate justification.

M. Joint Review, Revision, and Approval of Detailed Network:

1. Within 14 calendar days of receipt of Contractor's proposed Detailed Network, and within seven calendar days of receipt by Architect of Contractor's response, Architect, Contractor, and Owner shall meet for joint review, correction or

adjustment of proposed Detailed Network. Areas which, in opinion of Architect, conflict with timely completion of Project shall be subject to revision by Contractor.

2. If Contractor fails to define element of work, activity or logic, and Architects review does not detect this error or omission, update error or omission, current at next monthly update without change to Contract Time.
3. Within 7 calendar days after joint review, revise Network in accordance with agreements reached during review and submit one reproducible mylar sepia and three prints of revised Network.
4. Within 7 calendar days of receipt by Architect of revised Detailed Network, three copies of each revised Network and computer produced Schedule and furnish Cost Reports to Architect by Contractor. Include computer produced cashflow analysis generated by both early start and late start activity dates.
5. Upon establishment of agreed upon Project Schedule, sign on face of documents (Detailed Network and Schedule and Cost Report), indicating acceptance of Schedule.
6. Upon acceptance of Detailed Network by Owner, cost-loaded values of Network shall become basis for determining progress payments.
7. Acceptance of Project Schedule by Owner does not relieve Contractor of responsibilities for accuracy or feasibility of schedule, or Contractor's ability to meet Contract Completion date, nor does acceptance warrant, acknowledge or admit reasonableness of logic, durations, manpower or equipment loading of Project Schedule.

1.8 PROJECT SCHEDULE UPDATING

A. Updated on monthly basis throughout Contract Time and until Substantial Completion. Meet with Owner and Architect each month at Schedule Update meeting to review actual progress made through date of schedule update, including following:

1. Progress made to date, activities started and completed to date, and percentage of Work complete to date on each activity started but not complete.
2. Evaluate percentage of completed work with Contractor prepared estimates and supporting data.
3. Submit contractor prepared estimates of percentage completion of each activity and supporting data on or before 14th day preceding progress payment submittal deadline, including following information:

    a. One marked up copy of previous months Schedule Update Network indicating progress on schedule activities and revised (current) remaining durations. Legibly markup copy with felt-tip markers and red ink.
    b. One original and three reproduced marked up copies of previous months Schedule Update reports coordinated with other requirements above and indicating actual activity start or completion dates, revised current) remaining durations, and percent complete regarding activity cost.
    c. Indicate in writing those activities Contractor plans to work on during following update month and current or anticipated conditions which may delay work.

B. In case of disagreements at Schedule Update meeting concerning actual progress to date, Architect's determination shall govern.

C. Upon completion of Schedule Update meeting, which occurs on or before 7th day preceding progress payment submittal deadline, use input from meeting to revise Network to reflect progress as of date of Schedule Update and agreed revisions. Execute computer produced calculation to determine status of Project Schedule. Use percentage completions as required for preparation of monthly request for progress payment.

D. Forward two copies of each updated Project Schedule to Architect including:

1. Description of activities completed during preceding month.
2. Description of progress made on activities listed as started but not completed.
3. Description of revisions to schedule logic, initial activity durations, or activity costs.
4. Prints of updated Network indicating progress made up to date of Schedule Update and indicating revisions to Network.
5. Following computer produced reports:

    a. I-J.
    b. Total float.
    c. 60-day Early Start by I-J.
    d. 60-day Early Start by Responsibility Code.
    e. Cost report.

6. Include I-J, Total Float, and 60-day Early Start Schedule Reports listed for reach activity listed on Network:

    a. I-J Event Node Number(s).
    b. Activity Description.
    c. Original Destination.
    d. Remaining Duration.
    e. Activity Responsibility Code.
    f. Activity Early Start Date.
    g. Activity Early Finish Date.
    h. Activity Late Start Date.
    i. Activity Late Finish Date.
    j. Total Float.

E. If Contractor does not record exceptions to published Project Schedule Update within 14 calendar days after its issuance, Contract shall be deemed to have accepted revisions.

F. Monthly updating of Project Schedule shall be integral part and basic element of estimate upon which progress payments will be made. If, in opinion of Architect, Contractor fails or refuses to provide information required to accomplish complete Update, Contractor shall be deemed to have not provided required estimate upon which progress payments are based and shall not be entitled to progress payment until completed Update has been provided in accordance with requirements of this Section to satisfaction of Architect.

1.9 PROJECT SCHEDULE REVISIONS

A. Updating Project Schedule to reflect actual progress made up to date of Update shall not be considered revisions to Project Schedule.

B. If Project Schedule no longer represents actual progress of work, submit revision to Schedule.

C. If Contractor desires to make changes in Project Schedule to reflect revisions in method of operating and scheduling of work, notify Architect in writing, stating reason for proposed revision.

D. If revision to Schedule is contemplated, Contractor or Owner shall so advise other in writing at least 14 calendar days in advance of next Schedule Update meeting, describing revision and describing reasons for revision.

E. Reasonable requests by Contractor for revisions will be implemented by Owner.

F. Owner directed revisions to Project Schedule will not be incorporated into Schedule without written response from Contractor within 14 calendar days. Contractor's failure to respond within 14 days will be considered acceptance of Owner requested revisions, and such revisions will be incorporated into Schedule.

G. Make requests for revisions of activity manpower, activity costs, or redistribution of activity costs in accordance with requirements.

1.10 ADJUSTMENT OF TIME FOR COMPLETION

A. Time for Completion will be adjusted in accordance with requirements.

B. Accompany request for adjustment of time for completion because of changes or alleged delays with complete Time Impact Analysis submitted for within 30 calendar days after initial notice of delay.

C. Furnish information justifying request and stating extent of adjustment requested for each specific change or alleged delay. Each Analysis shall be on form and content acceptable to Architect. Include but do not limit to, general information set forth in this Clause appropriate to type of request (change or alleged delay) plus following:

1. Fragmentary CPM network illustrating how Contractor proposes to have change or alleged delay incorporated into current Update Schedule.
2. Identification of activities in current updated Project Schedule which are proposed to be amended due to change or alleged delay, together with engineering estimates and other appropriate data justifying proposal.
3. Take into account total allowable time of activity float time available for work involved in request.

1.11 TIME IMPACT ANALYSIS

A. When change Orders (including Proposed Change Orders) are initiated, delays are experienced, or Contractor desires to revise Project Schedule, submit to Architect written Time Impact Analysis illustrating influence of each Change Order, delay, or Contractor request on current Contract Completion date.

B. Base Time Impact Analysis on dates when change or changes were issued, or dates when alleged delay or delays began, status of work at that time, and include time computations for affected activities.

C. Activity delays shall not automatically mean that extension of Contract Time is warranted or due Contractor.

D. Float is not for exclusive use or benefit of either Owner or Contractor. Contract Time extensions will be granted only to extent equitable time adjustments to activity or activities affected by Change Order or delay exceeds total (positive or zero) float of critical activity (or path) and extends Contract Date.

E. Submit three copies of each Time Impact Analysis within 14 calendar days after commencement of delay or notice of direction for Change Order is given to Contractor.

F. Upon Architects review of Time Impact Analysis, to extension of time for completion of immediate contract milestone, time(s) for completion of milestone(s) will be adjusted by Architect, whether or not time for completion of overall Project Schedule is changed accordingly.

G. If Architect finds, after review of Time Impact Analysis that Contractor is entitled to extension of time for completion, time for completion will be adjusted by Architect and Owner will allow revision to Project Schedule.

H. Upon failure to submit Time Impact Analysis for change or alleged delay within 14 calendar days, or provide additional information as Architect may require, Architect will determine time impact of change or alleged delay. If this results in determination that adjustments should be made, Architect will issue direction at next Update meeting.

I. Incorporate Time Impact Analysis related to Change Order work or Contract Time extensions, into and attached to applicable Change Order.

1.12 RESPONSIBILITY FOR COMPLETION

A. Furnish sufficient forces. Include offices, facilities and equipment works hours, night shifts and overtime operations, as necessary to ensure execution of Work in accordance with monthly Project Schedule Update.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos on Project Web site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Aerial Documentation Qualifications: Firm specializing in aerial documentation, having minimum 10 years documented experience in professional unmanned aerial systems (drone) and having the necessary equipment (remote control quadcopters and hexacopters with gimbal mounted HD cameras, insurance, and FAA approvals for unmanned aerial documentation.

C. Drone Operator Qualifications: FAA Part 107 licensed drone operator, certified as an unmanned aircraft operator with a UAS rating for the operation of a commercial drone (unmanned aerial vehicle) pilot, having minimum 7 years as a drone operator with current certifications and is TSA vetted.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image editing software.

C. Metadata: Record accurate date and time and GPS location data from camera.

D. File Names: Name media files with date and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
2. Take 100 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take 100 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow up when on site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. Owner's request for special publicity photographs.

1.6 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements including:

1. Submittal schedule.
2. Shop drawings, coordination drawings, product data, and samples.
3. Verification submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List submittals required to maintain orderly progress of the work and those required early due to long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager, if applicable.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals:

1. All submittals on this Project are intended to be transmitted to the Architect in electronic format. Acceptable format includes PDF files with searchable text

options activated. Files shall be fully coordinated with integrated bookmarks outlining all primary, secondary and tertiary subsections of the document for navigation.

2. All electronic submittals shall be transmitted to the Architect using the identified Web Based Project Software and tracking system.
3. All samples and color selection charts, draw down cards or other such items for selecting colors, finishes and textures shall be provided to the Architect in hard copy form, linked to an electronic submittal file for tracking purposes only.

E. Transmittals:

1. Identification and Information: Identify and incorporate information in each electronic submittal file:

   a. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
   b. Name file with submittal number or other unique identifier, including revision identifier.

      1) File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01. A).

   c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

2. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number and date.

   a. Format: Use software generated form from electronic project management software acceptable to Project team, containing the following information:

      1) Project name.
      2) Date.
      3) File name and submittal number.
      4) Name and address of Architect.
      5) Name of Construction Manager. If applicable.
      6) Name of Contractor.
      7) Name of firm or entity that prepared submittal.
      8) Names of subcontractor, manufacturer, and supplier.
      9) Type of submittal.
      10) Specification Section number and title.
      11) Specification paragraph number or drawing designation and generic name for each of multiple items.
      12) Drawing number and detail references, as appropriate.
      13) Location(s) where product is to be installed, as appropriate.
      14) Related physical samples submitted directly.
      15) Indication of full or partial submittal.
      16) Transmittal number, numbered consecutively.

17) Submittal and transmittal distribution record.
18) Remarks.

b. Metadata: Include the following information as keywords in the electronic submittal file metadata:

1) Project name.
2) Number and title of appropriate Specification Section.
3) Manufacturer name.
4) Product name.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web Based Project Software: Prepare submittals in PDF form, and upload to web based Project software website. Enter required data in web based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized due to failure to transmit submittals enough in advance of the work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Consulting Engineers: Submit submittals for structural, mechanical, and electrical items directly to consulting engineer with copy of transmittal sent to Architect. Upon completion of review, consulting engineer will send its reviewed submittal to Architect.

3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Resubmittal Review: Allow 10 days for review of each resubmittal.
5. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 days for initial review of each submittal.
6. Submittals received by Architect after 2:00 p.m. Central Time will be considered as received the following workday.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Make revisions in submittals required by Architect, mark number of submission, and resubmit as required until accepted.
4. Shop Drawings and Product Data:

    a. Revise initial drawings or data, and resubmit as specified for initial submittal.
    b. Indicate changes been made other than those requested by Architect.
    c. Mark number of submission and resubmit until accepted.

5. Samples: Submit new samples as required for initial submittal. Remove samples which are rejected or designated as resubmit.
6. Resubmit submittals until marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

1. Distribute reproductions of reviewed Shop Drawings and Product Data that do not require revisions to the following:

    a. Job site file.
    b. Project Record Documents file.
    c. Other affected contractors.
    d. Subcontractors.
    e. Supplier or Fabricator.

2. Distribute accepted samples as directed by Architect.

F. Use for Construction: Retain complete copies of submittals on Project site. Use final action submittals marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule and in sequence that does not delay the work. Submittals shall be made to Architect by Contractor. Submittals from other entities will be returned unreviewed.

B. Electronic Submittal Requirements:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number, including revision identifier, and other unique identifiers at Contractor's discretion.

    a. File name and submittal number shall use the Specification Section number, with spaces, followed by a dash and then a sequential 3-digit submittal number (e.g., 061053 – 001). File name and submittal shall also include a 2-digit revision identifier suffix after another dash, starting with "00" on the initial submission (e.g., 061053 – 001 – 00).

3. Provide electronic stamp to permanently record Contractor's review and approval markings and space for electronic stamp for action taken by Architect and Consultants as needed.
4. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Project team, containing the following information:

    a. Project name.
    b. Date.
    c. File name and submittal number.
    d. Name and address of Architect.
    e. Name of Construction Manager.
    f. Name of Contractor.
    g. Name of firm or entity that prepared submittal.
    h. Names of subcontractor, manufacturer, and supplier.
    i. Type of submittal.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.

b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

6. Post electronic submittals in PDF format directly to Project Web site.
7. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Show performance characteristics and capacities.
c. Show dimensions and clearances required.
d. Manufacturer's technical data.
e. Color charts.
f. Statement of compliance with specified referenced standards.
g. Testing and test results by recognized testing agency.
h. Application of testing agency labels and seals.
i. Notation of coordination requirements.
j. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory installed wiring.
b. Wiring or piping diagrams and controls.
c. Printed performance curves.
d. Operational range diagrams.
e. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Manufacturer's Schematic Drawings and Diagrams: Modify drawings and diagrams to delete information that is not applicable.

a. Supplement standard information to provide information applicable to work.

6. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

D. Shop Drawings: Prepare Project specific information, drawn accurately to scale, indicating materials (kind, thickness, and finish), dimensions, connections, and details necessary to ensure accurate interpretation of the Contract Documents including attachment to other work, in detail necessary.

1. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
2. Identify details by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.
3. Consecutively number shop drawings for each portion of work. Retain numbering system throughout revisions.
4. Show detail, materials, dimensions, thickness, methods of assembly, attachments, relationship to adjoining work and pertinent data and information.
5. Verify dimensions and field conditions. Clearly indicate field dimensions and field conditions.
6. Verify and coordinate shop drawings for each specification section for each trade with requirements of related specifications and trades and as necessary for proper and complete installation of work.
7. Prepare composite shop drawings and installation layouts when necessary or requested to depict proposed solutions for field conditions. Coordinate in field and with affected subcontractors for proper relationship to work of other trades based on field conditions.
8. Preparation: Fully illustrate specified requirements. 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.

9. Paper Sheet Size: Except for templates, patterns, and similar full size Drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches (215 mm by 280 mm), but no larger than 30 inches by 42 inches (750 mm by 1067 mm).

E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Web Based Project Software: Prepare submittals in PDF form, and upload to web based Project software website. Enter required data in web based software site to fully identify submittal.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

F. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination" for preparation.

1. Conduct coordination meetings with trades attending to coordinate work of trades for each mechanical or electrical area.
2. Print Coordination Drawings using 1/4 inch (6 mm) minimum scale with congested areas and sections through shafts at 3/8 inch (4.5 mm) minimum scale.
3. Coordinate with architectural ceiling plans exact location and dimensioning of items which occur within hung ceilings. In event of conflict, request clarification from Architect as to correct locations of items in question.
4. Submit Coordination Drawings to Architect for review indicate conflicts that could not be resolved in coordination meeting. Submit total sleeving, piping, ductwork, lighting, sprinkler, and HVAC coordination drawings.
5. After review by Architect, prepare shop drawings for each separate trade.
6. Coordination drawings are for Architect's and Contractor's use during construction and shall not be construed as replacing shop drawings or Record Documents required by Contract Documents.

G. Product Schedule: Where required by the individual Specification Sections, prepare a written summary indicating types of products required for the work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

H. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

I. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

J. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

K. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed, and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

    1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Review of submittals is for compliance with design concept of Project and compliance with information stated in Contract Documents.

1. Contractor is responsible for verifying and correlating dimensions, information that pertains solely to fabrication process or to techniques of construction, and coordination of work of trades. Architect’s acceptance of a submittal does not relieve the Contractor of its responsibility for deviation from requirements of Contract Documents.

B. Action Submittals and Informational Submittals: Review each submittal and verify coordination with other work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

C. Contractor's Action: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval or submittals rejected by Contractor.

1.9 ARCHITECT'S REVIEW

A. Architect's review of Submittals is for general design conformance and compliance with information provided in Contract Documents. Contractor is responsible for complying with requirements and characteristics of products and systems specified; dimensions and quantities to be confirmed and correlated at the Project site; and information that pertains solely to fabrication processes, installation techniques, and coordination of work required by other trades. Architect's review and indication of action to be taken shall not relieve Contractor of responsibility for deviation from requirements of Contract Documents.

B. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it. Architect will indicate, via markup on each submittal, the appropriate action as follows:

1. Final Unrestricted Release: When submittal is marked "No Exception Taken," that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
2. Final But Restricted Release: When submittal is marked "Comments Included," that part of the Work covered by the submittal may proceed provided it complies with both the Architect's notations and comments on the submittal and requirements of the Contract Documents; final acceptance will depend upon that compliance.
3. Returned for Resubmittal: When submittal is marked "Revise and Submit," do not proceed with that part of the Work covered by the submittal, including

purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architects notations or corrections; resubmit without delay.

a. Do not permit submittals marked "Revise and Submit" to be used at the Project site or elsewhere where construction is in progress.

4. Rejected: When submittal is marked "Rejected" do not proceed with that part of the work as submission is either incomplete, not coordinated, or does not conform to requirements of Contract Documents. Resubmission of the same submittal will not be considered. Prepare and submit new submittal meeting requirements of Contract Documents.
5. Not Reviewed: When submittal is marked "Not Reviewed. Submittal not required by Contract Documents" it has not been reviewed because the submittal was neither requested nor required by Contract Documents.
6. Close Out Submittal: When submittal is marked "Reviewed for Project Close Out Requirements Only" it has been reviewed only for compliance with close out submission requirements. It has not been reviewed for accuracy or completeness. Burden of accuracy and completeness rests with the Contractor.
7. Substitution Request: When a submittal is marked "Proposed Substitution. Resubmit. Comply with Section 01 25 00 "Substitution Procedures," submission does not comply with requirements of Contract Documents. Contractor may elect to resubmit under the provisions, conditions, and procedures outlined in Section 01 25 00 "Substitution Procedures" or prepare and submit new submittal meeting requirements of Contract Documents.

C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements.

D. Partial Submittals prepared for a portion of the Work will be reviewed when use of partial Submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Architect will return without review submittals received from sources other than Contractor.

G. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

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SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle : To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:

    a. Owner's continuing occupancy of portions of existing building.
    b. Owner's partial occupancy of completed work.
    c. Other known work in progress.
    d. Tests and inspections.

3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Access to restricted areas may not be obstructed. Plan and execute the work accordingly.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at project site.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Fire prevention plan.
    c. Governing regulations.
    d. Areas where existing construction is to remain and the required protection.

e. Hauling routes.
f. Sequence of alteration work operations.
g. Storage, protection, and accounting for salvaged and specially fabricated items.
h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
i. Qualifications of personnel assigned to alteration work and assigned duties.
j. Requirements for extent and quality of work, tolerances, and required clearances.
k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at monthly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.

a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:

1) Interface requirements of alteration work with Project Work.
2) Status of submittals for alteration work.
3) Access to alteration work locations.
4) Effectiveness of fire prevention plan.

5) Quality and work standards of alteration work.
6) Change Orders for alteration work.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at project site.

1.6 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within 30 days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.7 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

a. Construct new mockups of required work whenever a supervisor is replaced.

B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead safe work practices.

C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate whole Project alteration work program with specific requirements of programs required in other alteration work.

1. Dust and Noise Control: Include locations of proposed temporary dust and noise control partitions and means of egress from occupied areas coordinated with continuing on site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

D. Fire Prevention Plan: Prepare a written plan for preventing fires during the work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire control devices during each phase or process. Coordinate plan with Owner's fire protection equipment and requirements. Include fire watch personnel's training, duties, and authority to enforce fire safety.

E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work

and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 degrees F (3 degrees C) or more above the dew point.

E. Storage Space:

1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security and climate control for stored material.
2. Arrange for offsite locations for storage and protection of salvaged material that cannot be stored and protected on site.

1.9 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the work by use of preconstruction photographs .

1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed.

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. Follow fire prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled Owner's Responsibility for Fire Protection.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat generating equipment or combustible materials, including welding, torch cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of welding or other high heat equipment. Use of open flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat generating equipment to shop areas or outside the building.
3. Do not perform work with heat generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire control equipment and alarms.
    b. Prohibit fire watch personnel from other work that would be a distraction from fire watch duties.
    c. Cease work with heat generating equipment whenever fire watch personnel are not present.
    d. Have fire watch personnel perform final fire safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area

to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

C. Fire Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs . Comply with requirements in Section 01 32 33 "Photographic Documentation."

D. Perform surveys of Project site as the work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality assurance and quality control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by quality provisions.
4. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, unless otherwise noted, experienced is defined as having a minimum of five years documented experience in work similar in nature, size, and extent to this project; familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality Control Tests: Tests and inspections that are performed on site for installation of the work and for completed work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a specialized construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Mockups: Full size physical assemblies that are constructed onsite either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface

between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not samples. Unless otherwise indicated, approved mockups establish the standard by which the work will be judged.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the work, to verify performance or compliance with specified criteria.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality Control Tests: Tests and inspections performed at the source; for example, plant, mill, factory, or shop.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate that actual products incorporated into the work and completed construction comply with requirements. Contractor's quality control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Delegated Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality Control Plan: Submit plan for quality assurance and quality control activities and responsibilities.

1. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

B. Qualification Data: Submit data for Contractor's quality control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Main wind force resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: Testing agencies who have demonstrated their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the work.

1.7 QUALITY CONTROL PLAN

A. Quality Control Plan: Submit quality control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality assurance and quality control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Quality Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality assurance and quality control procedures similar in nature and extent to those required.

1. Project quality control manager **may serve as Project superintendent**.

C. Testing and Inspection: In quality control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor performed tests and inspections including Subcontractor performed tests and inspections. Include required tests and inspections and Contractor elected tests and inspections. Distinguish source quality control tests and inspections from field quality control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner performed tests and inspections indicated in the Contract Documents.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified. Include the following:

1. Name, address, telephone number, and email address of factory authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm having a minimum of 5 years documented experience in manufacturing products or systems similar to those indicated, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory authorized service representative requirements.

B. Fabricator Qualifications: A firm having minimum 5 years documented experience in producing products similar to those indicated, a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Installer Qualifications: A firm or individual having minimum 5 years documented experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated, whose work has resulted in construction with a record of successful in-service performance.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.

E. Specialists: Certain Specification Sections require that specific construction activities are performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and be engaged for the activities indicated.

   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities, regardless if specified, to verify and document that the complies with requirements.

1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, regardless if specified.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when work that requires testing or inspection will be performed.
4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architectand Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architectand Contractor promptly of irregularities or deficiencies observed in the work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the work, and submittal of written reports.

G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents as a component of Contractor's quality control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, indicated in the Statement of Special Inspections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviewing the completeness and adequacy of those procedures to perform the work.
2. Notifying Architectand Contractor promptly of irregularities and deficiencies observed in the work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in the Statement of Special Inspections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspection, 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

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.

3.3 SCHEDULE OF SPECIAL INSPECTIONS

A. Testing of Earthwork:

1. Testing Services (As specified or required):

a. References (Applicable for tests required):

1) American Society for Testing and Materials (ASTM)

a) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3)
b) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
c) D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2) American Association of State Highway and Transportation Officials (AASHTO)

a) T89, Determining the Liquid Limit of Soils
b) T90, Determining the Plastic Limit and Plasticity Index of Soils
c) T99, Moisture Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop
d) T238, Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth)

b. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.
c. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
d. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
e. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,
f. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
g. Perform Moisture Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
h. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one (1) test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
i. Perform testing at a frequency of one in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three tests per lift

2. Reports: Submit reports with the following information:

a. Type and condition of soil at footing bottoms.
b. Level of water table in the excavated areas.
c. Grain size distribution of fill materials (average of three (3) tests).
d. Moisture density test results.
e. In place density test results with moisture content and relative density of each layer of compacted fill. Include within place density test results, a plan showing location of each test.
f. Notify Architect by telephone within one hour of the discovery of the following conditions and follow up telephone notification with written report.

1) Materials used, or degree of soil compaction not meeting specified requirements.
2) Frost and freeze protection requirements for excavation bottoms not being complied with.

a) Water in excavations which is not being removed prior to work being performed in excavation.

B. Inspection of Piped Site Utilities:

1. Laboratory representative shall observe and report on the following:

a. Proper alignment and grade of trenches.
b. Pipe bedding and supports.
c. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
d. Installation of pipe and joints.
e. Testing of piped utilities performed by Contractor.

C. Paving:

1. Testing Services: Perform field tests for moisture density properties:

a. Provide field testing of the subgrade as specified.
b. Paving Subbase: Provide one field test for every 5,000 square feet of area of crushed limestone or caliche subbase.
c. Lime Treated Subgrade: Provide one field test for every 5,000 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
d. Cement Soil Stabilization: Provide one field test for every 5,000 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

D. Pier Drilling Operation: Services shall be performed by a representative of a qualified geotechnical laboratory.

1. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.
2. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.
3. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:

a. Verify soundness of bearing stratum and desired penetration.
b. Verify pier dimensions and reinforcing used.
c. Monitor condition of hole and removal of water and loose material from bottom.
d. Monitor placement of concrete and use of tremie or pumps.
e. Monitor the extraction of casing, if used.

4. Request probe holes when deemed necessary to confirm safe bearing capacity.

E. Concrete Reinforcing Steel and Embedded Metal Assemblies:

1. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and, if left uncorrected, reported to the Architect.
2. Laboratory representative shall observe and report on the following:

    a. Number and size of bars.
    b. Bending and lengths of bars.
    c. Splicing.
    d. Clearance to forms, including chair heights.
    e. Clearance to sides and bottom of trench if soil formed.
    f. Clearance between bars or spacing.
    g. Rust, form oil, and other contamination.
    h. Grade of steel.
    i. Securing, tying, and chairing of bars.
    j. Excessive congestion of reinforcing steel.
    k. Installation of anchor bolts and placement of concrete around such bolts.
    l. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
    m. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

3. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years' experience inspecting reinforcing steel in projects of similar size.

F. Concrete Inspecting and Testing: Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio and slump in accordance with ACI 613 and 318.

1. Comply with ACI 311 Guide for Concrete Inspection and ACI Manual of Concrete Inspection (SP-2).
2. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.
3. Test concrete:

    a. Mold and cure five specimens from each sample.

1) For each 50 cubic yards or fraction thereof of structural building concrete; and
2) For each 100 cubic yards or fraction thereof of nonstructural concrete and site work paving and sidewalks.
3) Laboratory cure two cylinders in accordance with ASTM C192.
4) Field cure remaining cylinders in accordance with ASTM C31.

b. Two specimens shall be tested at seven days for information, two shall be tested at 28 days for acceptance.
c. Store one cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements.

4. Deviations from the requirements of ASTM Scifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.
5. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
6. Supervise curing and protection provided for test specimens in field, and transportation from the field to laboratory. Test cylinders shall be stored in the field 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.
7. Make one strength test (four cylinders) of each mix design of concrete placed in any one day.
8. Make one slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.
9. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.
10. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.
11. Determine temperature of concrete sample for each strength test.
12. Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94.

    a. Monitor addition of water and high range water reducer to concrete at job site and length of time concrete is allowed to remain in truck during placement.

13. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day’s mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.
14. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete remains in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any

significant deviation to the Architect, Contractor and concrete supplier. Do not permit addition of water which will exceed maximum water/cement ratio for the mix as given on the approved mix design.

15. Observe placing of concrete, except nonstructural slabs on grade and site work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.
16. Test reports shall include but no be limited to the following information: date of concrete placement, concrete mix identification number or proportion of ingredients, truck ticket number, time test was made, time of batching, location of each placement, slump, unit weight, water content (microwave test) and air content of concrete sampled and date and results of strength test.
17. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.
18. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.
19. Evaluation and Acceptance:

    a. If measured slump, or air content of air entrained concrete, falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the specifications and shall not be used in the structure.
    b. Strength level of concrete will be considered satisfactory if the averages of sets of three consecutive strength tests results are equal to, or exceed, specified strength and no individual test result (average of two cylinders) is below specified strength by more than 500 psi.
    c. Completed concrete work will be accepted when requirements of ACI 301 Chapter 18 Specifications for Structural Concrete for Buildings have been met.

20. Concrete Test Reports: Reports shall be made and distributed immediately after respective tests or inspections are made.

    a. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.

21. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:

    a. Strength tests at seven days.
    b. Strength tests at 28 days of two cylinder averages.
    c. 28 day moving average strength tests of last three test groups.

d. Standard deviation and coefficient of variation based on 28 day strength tests.
e. Average strength and number of 28 days tests for most recent month.
f. Strength test one cylinder at 56 days in the event the 28 days strength tests do not meet strength requirements.

22. Test Footings (Shafts) (Piers) (Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the work.
23. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.
24. Inspect application of curing compound and monitor curing conditions to assure compliance with specification requirements. Report curing deficiencies to the Contractor immediately and submit a written report to the Architect.

G. Testing of Nonshrink Grout:

1. Make one strength test for all plates grouted and for all grout used in joints between members.
2. Each test shall consist of four cubes, two tested at 7 days and two at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

H. Structural Steel: Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator’s quality control procedures and capabilities.

1. Field Inspection:

a. Proper erection of pieces.
b. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
c. Proper installation of bolts.
d. Plumbness of structure and proper bracing.
e. Proper field painting.
f. Initial inspection of welding process and periodically thereafter as necessary.
g. Visual examination of completed welds.
h. Ultrasonic testing of penetration field welds.
i. Installation of field welded shear studs.
j. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
k. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside specified camber tolerance to shop for correction.

2. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on work, along with certification that each welder has passed qualification tests within the past 12 months, using

procedures covered in AWS D1.1 Structural Welding Code - Steel. Verify welder qualifications.

3. Inspection of field welding shall include:

    a. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
    b. Visually inspect welds for proper repair of painting.
    c. Ultrasonically test penetration welds in accordance with ASTM E164.
    d. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
    e. Welding inspector shall be present during alignment and fit up of members being welded and verify correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to 2 inches (50 mm) beyond each end of crack.
    f. Inspector shall verify that welds have been marked with welder's symbol and shall mark welds requiring repairs and reinspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and work identified by word reject or repair marked directly on the material.
    g. Testing agency shall advise the Owner and Architect of any shop and/or field conditions which may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.
    h. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
    i. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
    j. Determine percentage of weld tested by the number of welds that fail the initial testing.
    k. Reweld and retest welds that fail until the welds pass. Test two additional welds for every weld failure.

4. Inspect bolted construction in accordance with AISC Specification for Structural Steel Buildings:

    a. Visually inspect bolts ensuring that plies have been brought into snug contact.
    b. Inspect high strength bolt in accordance with Section 9 of the Specifications for Structural Joints Using ASTM A325 or A490 Bolts.

5. Inspect stud welding in accordance with Section 7.8, of AWS D1.1 Structural Welding Code:

    a. Weld at least two shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The

studs shall be capable of being bent 45 degrees from vertical without weld failure.

b. When the temperature is below 32 degrees F (0 degrees C), test one stud in each 100 after cooling. Do not weld studs at temperatures below 0 degrees F or when surface is wet with rain or snow. If stud fails in the weld, two new studs shall pass the test before resumption of welding.
c. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

I. Reinforcing Steel Mechanical Splices:

1. Inspection and Observation Services:

a. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
b. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
c. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.

2. Reports: Submit reports to Architect:

a. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
b. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.

J. Open Web Joists and Joist Girders: Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.

1. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.
2. Verify welder qualification certificates for both shop and field welding operators.

K. Metal Floor Deck:

1. Field inspection shall consist of:

a. Verifying types, gauges and finishes for compliance with Contract Documents and shop drawings.
b. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the specifications.

c. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.
d. Certification of welders.
e. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.

L. Metal Roof Deck:

1. Field inspection shall consist of:

a. Verify types, gauges and finishes for compliance with Contract Documents and shop drawings.
b. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
c. Certification of welders.
d. Visual inspection of at least 25 percent of welds.

M. Sprayed Fire Resistant Materials:

1. Verify applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.
2. Verify installation complies with fire rating requirements of approved design.
3. Inspect and test for thickness:

a. Test 25 percent of structural frame columns and beams in each building level.
b. Test 10 percent of beams other than structural frame in each building level.
c. Test one slab per 5,000 square feet of building area.

4. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

N. Mastic and Intumescent Fire Resistive Materials:

1. Verify applied fire resistant coatings complies with fire rating requirements of approved design.

O. Fire Resistive Joint System:

1. Verify fire resistant joint systems are tested and listed in accordance with IBC Section 715.3 and Section 715.4 and inspected in accordance with ASTM E2393.

P. Exterior Insulation and Finish System (EIFS).

Q. Smoke Control: Test smoke control system.

R. Water Resistive Barrier Coating: When applied to building sheathing, verify water resistive barrier coating complies with ASTM E2570.

S. Expansion Bolt Installation: Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.

1. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

T. Lightweight Insulating Concrete Fill:

1. Inspection and Observation Services (As required):

a. Inspection of roof deck prior to start of work.
b. Inspection during installation of insulation and lightweight insulating concrete fill work to ascertain compliance with Contract Documents.
c. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

2. Testing Services (As required):

a. References (As applicable for tests required):

1) American Society for Testing and Materials (ASTM)

a) C177, Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus
b) C495, Test Method for Compressive Strength of Lightweight Insulating Concrete
c) C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation

b. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
c. Test lightweight insulating concrete fill in accordance with ASTM C495 for:

1) Mix design compressive strength.
2) Mix design wet and dry density range.
3) Number of Tests:

a) One per 5,000 square feet
b) Not less than one for each day's work

d. Test EPS insulation board for density in accordance with ASTM C578.

U. Testing of Roofing:

1. Inspection and Observation Services (As required):

a. Inspection of roof deck prior to start of work.
b. Inspect on site condition of stored roofing materials.
c. Inspection during roofing, roof insulation, and sheet metal work to ascertain compliance with Contract Documents.

d. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
e. Observation of patching of roof test cuts to ascertain that they are properly made.

2. Testing Services (As required):

a. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.

V. Masonry:

1. Inspection and Observation Services:

a. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
b. Review mortar design mixes.
c. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

2. Testing Services:

a. References (As applicable for tests required):

1) ASTM International (ASTM)

a) C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units
b) C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
c) C1019, Standard Test Method for Sampling and Testing Grout
d) E447-97, Standard Test Methods for Compressive Strength of Laboratory Constructed Masonry Prisms

b. Testing of Concrete Masonry Units (CMU):

1) Preconstruction: Perform the following tests in accordance with ASTM C140.

a) Compressive Strength
b) Absorption
c) Weight
d) Moisture Content
e) Dimensions

c. Mortar Tests:

1) Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.

2) 28 Day Compressive Strength
3) Water Retention
4) Construction: Perform 28 day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one test per 2,000 square feet of masonry.

d. Refer to and include work for reinforcing steel specified.
e. Grout Tests:

1) Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.

a) Slump Test
b) 28 Day Compressive Strength
c) Construction: Perform 28 day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
d) Prism Test: Perform preconstruction 28 day compressive strength test on concrete masonry walls in accordance with ASTM E447-97, Method B.

W. Seismic Resistance Testing and Inspections: In Seismic Design Categories D, E, or F:

1. Structural Observation.
2. Periodic Special Inspection for Architectural Components:

a. Erection and fastening of exterior cladding.
b. Exterior and interior nonloadbearing walls.
c. Exterior and interior veneer.
d. Anchorage of access floors.

3. Plumbing, mechanical, and electrical components:

a. Anchorage of electrical equipment for emergency and standby power systems.
b. Anchorage of electrical equipment.
c. Installation and anchorage of piping systems design to carry hazardous materials.
d. Installation and anchorage of vibration isolation system where there is nominal clearance of 1/4 inch (6 mm) of less between equipment support frame and restraint.

4. Anchorage of storage racks 8 feet (2438 mm) or greater in height.
5. Seismic isolation systems.

X. Structural inspection for wind requirements.

Y. Special inspections and tests for proposed work required by the Building Official, including but not limited to:

1. Construction materials and systems that are alternative to materials and systems prescribed by the Code.
2. Unusual design applications of materials.
3. Materials and systems required to be installed in accordance with additional manufacturer instructions that prescribe requirements not address by code or referenced standards.

END OF SECTION

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SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Regulatory requirements.

1.2 GOVERNING REQUIREMENTS

A. Governing Law: Applicable governing laws, codes, and regulations of the jurisdiction of the location of the project are found in the Contract Documents.

B. Codes, Regulations, and Standards:

1. Where references are made on Drawings or Specifications to codes, they shall be considered an integral part of the Contract Documents as minimum standards. Nothing contained in Contract Documents shall be construed to conflict with law, bylaws, or regulation of municipal, State, Federal, or authorities having jurisdiction.
2. Perform Work in compliance with the Building and other Codes listed on Drawings as adopted by the City of Rockwall, Texas.
3. Perform work in compliance with:

    a. The Building Codes listed on Drawings.
    b. National, state, and local barrier free regulations, laws, and ordinances.

1.3 FIRE RESISTANCE REQUIREMENTS

A. Fire Resistance Ratings and Fire Tests: Determine fire resistance ratings of building elements, components, and assemblies in accordance with the test procedures set forth in ASTM E119 or UL 263, or by alternative methods approved by applicable authorities having jurisdiction.

1. Determine fire resistance ratings or listing based on fire tests performed by one of the following testing agencies, or an agency acceptable to governing authorities having jurisdiction.

    a. Factory Mutual Laboratories.
    b. Intertek.
    c. Southwest Research Institute.
    d. Underwriters Laboratories, Inc.

2. Where reference is made to one testing authority, equivalent fire ratings determined or listed by another testing agency are acceptable if approved by applicable authorities having jurisdiction.

B. Marking and Identification: Permanently identify fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions, and other walls or partitions required to have protected openings or penetrations with signage or stenciling. Identification shall be:

1. Located in accessible floor plenums, ceiling plenums, or attic spaces as applicable.
2. Repeated at intervals not exceeding 30 feet (10 m) o.c., measured horizontally along the partition or wall.
3. Of lettering not less than 1/2 inch (13 mm) in height, worded as follows: "FIRE AND/OR SMOKE BARRIER - PROTECT OPENINGS AND PENETRATIONS."

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are necessary to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

A. Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Fire Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

F. Moisture and Mold Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.

G. Dust and HVAC Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air filtration system discharge.
4. Waste handling procedures.
5. Other dust control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 and Texas Accessibility Standards (TAS).

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain Link Fencing: Minimum 2-inch (50-mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Polyethylene Sheet: Reinforced, fire resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E84 and passing NFPA 701 Test Method 2.

D. Dust Control Adhesive Surface Walk Off Mats: Provide mats minimum 36 inches by 60 inches (914 mm by 1524 mm).

E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 1 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4 foot (1.2 m) square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 degrees F to 72 degrees F (20 degrees C to 22 degrees C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Use of Owner’s existing permanent HVAC system is permitted to the extent it is available during the work.

1. Use of gasoline burning space heaters, open flame heaters, or salamander type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with minimum MERV of 8 at each return air grille in system, remove at end of construction, and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

C. HVAC Equipment: Provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control.

1. Use of gasoline burning space heaters, open flame heaters, or salamander type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."

D. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. Connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
2. When tapping into Owner’s existing services, coordinate with Owner’s Representative before tapping into existing utility services available in the facility.

B. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Provide electric distribution system of sufficient size, capacity, and power characteristics required for construction operations.
3. Connect temporary service to Owner's existing power source as directed by Owner.

C. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

D. Water Service: Install water distribution piping in sizes and pressures adequate for construction.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, provided facilities are cleaned and maintained in a sanitary condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

    a. Provide toilet paper, paper towels, and related accessories and maintenance items.
    b. Thoroughly clean and disinfect toilet rooms daily.
    c. At the end of the work, thoroughly clean and sanitize, disinfect, and restore toilet rooms to like new condition. Replace plumbing fixtures and toilet accessories broken, damaged, or removed by construction personnel. If necessary, repaint paintable surfaces.

F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select

equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the work. Use vacuum collection attachments on dust producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common use facilities for use by all construction personnel. Install WiFi cell phone access equipment and at least one land based telephone line(s) for each field office.

1. Provide additional telephone lines as determined by useage.
2. At each telephone, post a list of important telephone numbers.

    a. Police and fire departments.
    b. Ambulance service.
    c. Contractor's home office.
    d. Contractor's emergency afterhours telephone number.
    e. Architect's office.
    f. Engineers' offices.
    g. Owner's office.
    h. Principal subcontractors' field and home offices.

3. Include costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by party who places call.

J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Core i5 or i7.
2. Memory: 4 gigabyte.
3. Disk Storage: 500 gigabyte hard disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24 inch (610 mm) LCD monitor with 256-Mb dedicated video RAM.
5. Full size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet or Gigabit.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:

    a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
    b. Adobe Reader 11.0 or higher.
    c. WinZip 7.0 or higher.

9. Printer: All in one unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 1.0 Mbps upload and 15 Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 2 terabyte, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Install and maintain support facilities until Substantial Completion inspection. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Facilities and Services:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

D. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot mix asphalt pavement until immediately before Substantial Completion. Repair hot mix asphalt base course pavement before installation of final course according to Division 32.

E. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for firefighting equipment and access to fire hydrants.

F. Parking: Provide temporary parking areas for construction personnel.

1. Parking is limited. Provide temporary parking unless Owner designates parking areas for construction personnel.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs so they are legible at all times.

I. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities

having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered tools and equipment and are not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with specified work restrictions.

C. Pest Control: Engage pest control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

H. Temporary Partitions: Provide floor to ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood.

    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.

3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air handling equipment.
7. Provide walk off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed work, and replacing water damaged Work.

2. Indicate sequencing of work that requires water, such as sprayed fire resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 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," 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 by Architect 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 single manufacturer's product is named and accompanied by the words "basis of design product," including make or model number or other designation. In addition to the basis of design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. Should a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.3 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis of design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with specified requirements.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Architect's Approval of Submittal: Specified in Section 01 33 00 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 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.

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. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service connected or power operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.

d. Speed.
e. Ratings.

3. Refer to individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.5 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 site.
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 losses.
3. Deliver products to 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 to avoid endangering Project structure and building elements.
3. Store products 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.
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.

1.6 PRODUCT WARRANTIES

A. Warranties specified in the specification sections are 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.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a product and specifically endorsed by manufacturer to Owner.

2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified and coordinated 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. Refer to the individual specification sections for specific content requirements and requirements for submitting warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

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 meeting 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.

a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"

4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

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 Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect 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.

2.2 SUSTAINABLE PRODUCTS

A. Where the Specifications include products with sustainable attributes, select products that comply with sustainability requirements.

1. Where there is an option to provide one of the listed products, give preference to products with minimal packaging and easily recyclable packaging.
2. Maximize use of source reduction and recycling procedures.
3. Provide environmentally preferable products (EPP) to the extent possible.

    a. Environmentally Preferable Products: Products and materials that have a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

2.3 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
4. Samples, if requested.

B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General administrative and procedural requirements governing execution of the work including, but not limited to, the following:

1. Installation of the work.
2. Coordination of Owner installed products.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.

1.2 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. Existing Materials: Use materials for patching identical to existing materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of existing materials.

C. Progress Cleaning:

1. Provide covered containers for deposit of waste materials, debris and rubbish.
2. Use cleaning materials that do not create hazards to health and property and do not damage surfaces.
3. Use cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the work is required, include the following:

a. Description of the work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the work constitutes acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 INSTALLATION

A. 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.
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.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. 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.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Sequence the work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

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. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. 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.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

K. Repair or remove and replace damaged, defective, or nonconforming work.

1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective work.

3.4 OWNER INSTALLED PRODUCTS

A. Site Access: Provide access to the site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.5 PROGRESS CLEANING

A. Clean project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F (27 degrees C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint use areas where Contractor and contractors are working concurrently.
5. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate conditions that could affect final finishing.

B. Site: Maintain Project free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the work, broom clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using 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.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal:

1. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F (27 degrees C).
2. Provide onsite dumpsters and containers for collection of waste materials, rubbish, and debris.

3. Do not allow waste materials, rubbish, and debris to accumulate and become an unsightly and hazardous condition. Provide additional collection and dispose of debris when scheduled removal is inadequate to prevent accumulation.
4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to EPA and local regulations.

    a. Utilize containers intended for holding hazardous waste to be stored.

5. Terminate closed chutes into appropriate containers with lids. Open free fall chutes are not permitted.
6. Do not overload trucks to prevent spillage on access and haul routes. Examine traffic areas and maintain clear routes.
7. Clean site and work areas daily, including common areas. Enforce requirements strictly. Legally dispose of waste materials, rubbish, and debris away from site.

    a. Do not bury or burn waste materials onsite. Do not wash waste materials down sewers or into waterways.
    b. Legally dispose of waste materials and comply with disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

H. 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.

I. 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.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

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

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Closeout submittals and warranties.
4. Payment and release of liens.
5. Final cleaning.
6. Repair of the work.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data for each type of cleaning agent.

B. Contractor's List of Incomplete Items (Punchlist): Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

A. Submit the following:

1. Final application for payment.
2. Certificate of Occupancy.
3. Certificate of inspections for mechanical and electric systems.
4. Certificates of Release: Certificates from authorities having jurisdiction.
5. Certificate of Insurance: Certificates for continuing coverage.
6. Certificate of Insurance for Products and Completed Operations.
7. Project record documents.
8. Operation and maintenance data.
9. Warranties and bonds.
10. Evidence of payments and release of liens.
11. Final adjustment of accounts.
12. Spare parts, maintenance materials, and extra materials.
13. Field Report: Report of pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: Submit extra materials as specified in the individual specification sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Upon determination that the work is substantially complete, notify Architect and submit written certification that the Work is complete.

B. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

1. Contractor’s failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

C. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. 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.
2. Submit specified closeout submittals, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit extra materials specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of extra material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

D. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.

2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified.
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

E. Substantial Completion Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 7 days prior to date the work will be completed and ready for inspection and tests accompanied by the list of incomplete items.

1. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.
2. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents, the Architect will supplement the Contractor’s list with such items.

    a. Architect’s failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

3. Architect will prepare the Certificate of Substantial Completion 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.
4. Reinspection: Upon correction of deficiencies, notify Architect requesting a reinspection accompanied by the list of items to be complete or corrected and date of anticipated completion.

F. Substantial Completion: Upon concurrence that the project is substantially complete, the Architect will prepare a Certificate of Substantial Completion on AIA Form G704 accompanied by the Constructor’s List of Incomplete Items that has been verified and amended by Architect.

1. The Architect will submit the Certificate of Substantial Completion to the Owner and Contractor for written acceptance of the responsibilities assigned in the Certificate.

G. Contractor Activities: Upon receipt of the certification of Substantial Completion, perform the following activities:

1. Allow Owner occupancy of the project as stated in the Certification of Substantial Completion provisions.
2. Obtain and submit the Certificate of Occupancy, operating certificates, and similar releases enabling the Owner unrestricted use of the work.
3. Complete work listed for completion or correction within designated form.
4. Advise Owner of pending insurance change over requirements.
5. Perform final cleaning.
6. Make final changeover of permanent locks and transmit keys to Owner.
7. Advise Owner of change over in security provisions.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit final Application for Payment in accordance with Section 01 29 00 "Payment Procedures." and the Agreement.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items for completion or correction (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Equipment Testing: Submit certified list of completed testing of installed equipment and system stating that testing was performed in the presence of the Owner’s representative and are operational.
4. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
5. Submit pest control final inspection report.
6. Submit final completion photographic documentation.

B. Final Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests.

1. Inspection: On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. 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.
2. Reinspection: Request reinspection when the work identified in previous inspections as incomplete is completed or corrected with written certification that:

    a. The Contract Documents have been reviewed and the work has been examined for compliance and completed in accordance with Contract Documents.
    b. Equipment and systems have been tested in presence of Owner's representative and are operational.
    c. The work is completed and ready for final examination.

C. Determination of Final Completion: Architect will inspect the work to verify status of completion within seven calendar days after receipt of certification.

1. Should Architect deem the work is incomplete or defective, the Architect will notify Contractor in writing, itemizing the work that is incomplete or defective.
2. Take immediate action to finish incomplete work and remedy deficiencies before requesting a second inspection accompanied by a second written certification that work is complete.
3. Architect will reinspect the work.

    a. If the work is found complete, Architect will request submission of closeout submittals.
    b. If the work is again found incomplete, complete the work and request a reinspection accompanied by a third written certification that work is complete.

1.7 REINSPECTION FEES

A. In the event the Architect is required to perform reinspections due to the failure of the work to comply with claims of completion certified by Contractor:

1. The Owner will compensate Architect for additional services.
2. The Owner will deduct amount of compensation from final payment to Contractor.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. 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.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following formats:

    a. MS Excel electronic file. Architect will return annotated file.
    b. PDF electronic file. Architect will return annotated file.

1.9 CLOSEOUT SUBMITTALS

A. Upon request of Architect after a successful Final Completion Inspection, submit the following documents for closeout:

1. Evidence of compliance with requirements of governing authorities:

    a. Certificate of Occupancy.
    b. Certificate of Inspection: Mechanical and electrical systems.

2. Project Record Documents: Refer to Section 01 78 39 "Project Record Documents."
3. Operating and Maintenance Data: Refer to Section 01 78 23 "Operation and Maintenance Data."
4. Warranties and bonds.
5. Spare Parts and Maintenance Materials: Provide products, spare parts, and maintenance materials in quantities specified in each specification section in addition to that required for completion of work.

    a. Coordinate delivery with Owner; deliver to site, store properly, and obtain receipt prior to final payment.

6. Certificates of Insurance:

    a. Certificates for products and completed operations.
    b. Certificate for continuing coverage.

7. Field Report: Submit report for pest control inspection.

1.10 PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents in an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web based project software site.

E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy duty, three ring, vinyl covered, loose leaf binders, thickness necessary to accommodate contents, and sized to receive 8-1/2 inch by 11 inch (215 mm by 280 mm) paper.
2. Provide heavy paper dividers with plastic covered tabs for each separate warranty. Mark 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 Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.11 PAYMENT AND RELEASE OF LIENS

A. Evidence of Payment:

1. Contractor's Affidavit of Payment of Debts and Claims: AIA G706.
2. Contractor's Affidavit of Release of Liens: AIA G706A.
3. Attachment to Contractor's Affidavit of Release of Liens:

a. Consent of Surety to Final Payment: AIA G707.
b. Contractor's Release or Waiver of Liens.
c. Separate releases of waivers of liens from subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.

4. Submittals shall be duly executed before delivery to Owner.

B. Adjustments of Accounts: Submit final statement of accounting to Architect.

1. Statement shall reflect adjustments to Contract Sum: Include the following data:

a. Original Contract Sum.
b. Additions and deductions resulting from:

1) Previous Change Orders.
2) Allowances.
3) Unit Prices.
4) Deductions for uncorrected work.
5) Penalties and bonuses.
6) Deductions for liquidated damages.
7) Deductions for reinspection payments.
8) Other adjustments.

c. Total Contract Sum, as adjusted.
d. Previous payments.
e. Sum remaining due.

C. Upon receipt and review, Architect will prepare final Change Order, reflecting approved adjustments to Contract Sum that were not previously made by Change Orders.

D. Final Application for Payment: Refer to Section 01 29 00 "Payment Procedures."

E. Adjustment: No adjustments to Contract requested by Contractor will be allowed if asserted after execution of Final Payment of Contract.

1.12 CONTRACTOR CORRECTION PERIOD

A. Prior to expiration of the Contractor’s Correction Period prior to the one year anniversary of the Date of Substantial Completion, Owner and Contractor will make visual inspection of the project to determine whether further correction of work is required in accordance with provisions of Contract Documents.

B. During the Correction Period, the Owner will promptly notify the Contractor in writing of observed deficiencies. Schedule a time and establish a schedule for correction of deficiencies.

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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. 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. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire project or for a designated portion of project:

    a. Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard surfaced finishes to a dirt free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and noticeable, vision obscuring materials. Replace chipped or broken glass and damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

E. Testing and Inspections: Comply with Section 01 40 00 "Quality Requirements" and the individual specification sections for required testing and inspections.

1. Submit a schedule of tests and inspections and indicate the date results of inspections and testing.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.

9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4 "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.

8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties: Submit copies of warranties and lists of circumstances and conditions that would affect validity of warranties or bonds. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Submit manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Submit lists of materials and local sources of materials and related services.

G. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit clean set(s) of marked up record prints.

a. Initial Submittal:

1) Submit one paper copy set of marked up record prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one clean paper copy set(s) of marked up record prints.
2) Submit PDF electronic files of scanned record prints.
3) Print and PDF each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one annotated paper copy and an annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and an annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous recordkeeping requirements and submittals in connection with various

construction activities. Submit one paper copy and an annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 BURDEN OF ACCURACY

A. The burden of accuracy is the responsibility of the Contractor who shall bear costs of damages incurred by Owner due to inaccuracies or incompleteness of submitted Record Documents for the period of time following Substantial Completion defined by Agreement and the Conditions of the Contract.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red colored pencil. Use other colors to distinguish between changes for different categories of the work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

    1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
    2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
    3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
    4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and an annotated paper copy of the project manual.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

    1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
    2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
    3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file and a paper copy.

    1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Miscellaneous record submittals include but are not limited to:

1. Reviewed shop drawings, product data, and samples.
2. Field test reports.
3. Inspection certificates.
4. Manufacturer's certificates.
5. Inspections by authorities having jurisdiction.
6. Documentation of foundation depths.
7. Special measurements or adjustments.
8. Tests and inspections.
9. Surveys.
10. Design mixes.

B. Format: Submit miscellaneous record submittals as PDF electronic file and a paper copy.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 RECORD DOCUMENTS

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to the Documents as they occur. Do not wait until the end of the project. Architect will periodically review record documents to assure compliance.

B. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

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SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements including cutting away, breaking out, and removing portions of existing paving.
3. Removal of designated equipment and fixtures.
4. Identification of utilities.
5. Legal offsite disposal of demolition materials.
6. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 ACTION SUBMITTALS

A. Schedule: Submit sequence of demolition operations to Owner for review prior to start of work to prevent interruption of onsite operations.

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Coordinate shutoff, capping, and continuation of utility services as required and interruption of utility services.
3. Details for dust and noise control protection.
4. Coordinate with Owner's continuing occupation of portions of existing building.
5. Use of elevator and stairs.
6. Location of salvageable items.
7. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on site operations.
8. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
9. Locations of temporary partitions and means of egress.

B. Shop Drawings: Indicate location and construction of temporary work.

C. Concrete Cutting: Submit 3 copies of proposed cutting procedures and operations for each type of concrete demolition for review and approval prior to starting the work. Outline types of equipment proposed, protections to be installed, and cutting schedule.

D. Roof Removal: Submit procedures indicating compliance with manufacturer's warranty (if required) and schedule for roof removal.

1.5 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property form dust control and noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Dust and noise control protection
5. Location of salvageable items.
6. Location of construction for temporary work
7. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed work.

D. Permits: Submit permits, notices and certificates authorizing demolition work, necessary for utility work, and for transportation and disposal of debris.

E. Project Record Documents: Accurately record actual locations of capped utilities, subsurface obstructions, and insert other pertinent items.

F. Warranties: Documentation indicating that existing warranties remain in effect after completion of selective demolition.

G. Inventory: Submit a list of items for removal and salvage prior to start of demolition.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
2. Obtain required permits from authorities having jurisdiction.

B. Predemolition Conference: Conduct conference at site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 FIELD CONDITIONS

A. Occupancy: Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:

1. Interruption of power.
2. Interruption of utility services.
3. Excessive noise.

B. Condition of Structure: Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not anticipated that hazardous materials will be encountered in the work.

1. Hazardous materials will be removed by Owner prior to the commencement of the work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract. Work shall continue in other areas of project unaffected by hazardous materials.

E. Storage or sale of removed items or materials on site is not permitted.

F. Traffic: Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities.

1. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.

G. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

H. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.

I. Utility Services: Maintain existing utilities and protect against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.
2. Maintain fire protection facilities in service during selective demolition operations.

J. Protections: Provide temporary barriers to protect Owner's personnel and public from injury from work.

1. Take protective measures to provide free and safe passage to occupied portions of building.
2. Provide protection to ensure safe passage of the Owner’s personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
3. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

4. Protect existing work which becomes exposed during demolition operations.

    a. Protect existing improvements, appurtenances, and conditions to remain.
    b. Protect adjacent floors with coverings.
    c. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.

5. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
6. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.

K. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

L. Firearms and Explosives: Firearms and explosives are not permitted at the site.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

B. Coordinate selective demolition work with cutting and patching requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Demolition Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 MATERIALS

A. Repair Materials: Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials visually matching existing adjacent surfaces.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

D. Verify hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings or preconstruction photographs and video.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTIONS

A. Temporary Protection: Provide temporary barricades and protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

    a. Erect temporary pathways and means of egress necessary for ongoing operations compliant with Code and accessibility regulations.
    b. Provide temporary barricades and protection required to prevent injury and damage to adjacent buildings and facilities to remain.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

    a. Protect existing work which becomes exposed during demolition operations.

b. Protect adjacent entrances from damage due to demolition activities.
c. Protect existing improvements, appurtenances, and conditions to remain.
d. Protect floors with covering.
e. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

a. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
b. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
c. Insulate partition to provide noise protection to occupied areas.
d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
e. Protect air handling equipment.
f. Weatherstrip openings.

6. Damage: Promptly repair damages to adjacent components cause by demolition activities.

B. Temporary Partitions and Enclosures: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter to prevent dust from mitigating to occupied areas. Equip partitions with dustproof doors and security locks.
4. Protect air handling equipment.

C. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

D. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

E. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. Conduct demolition to minimize interference with existing and adjacent building areas and to cause as little inconvenience to Owner and employees of occupied buildings as possible. Do not interfere with use of adjacent public streets.

1. Cease operations immediately if structure appears to be in danger and notify Architect. Do not resume operations until directed.
2. Maintain protected egress and access to work.
3. Do not burn or bury materials on site. No explosive or blasting will be allowed for demolition.

B. Demolish and remove existing construction to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
6. Maintain ventilation when using cutting torches.
7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly and legally dispose off site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

D. Removed and Salvaged Items: Remove items and equipment indicated for salvage. Photograph items with existing damage prior to removal. Submit list of damage items with supporting photographs and videos. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner.

1. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items: Clean and repair items to functional condition adequate for intended reuse.

1. Pack or crate items after cleaning and repairing. Identify contents of containers.
2. Protect items from damage during transport and storage.
3. Store items in secure storage, off ground, and covered. Protect until items are reinstalled.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in original locations after selective demolition operations are complete.

G. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.

E. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

F. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches (150 mm) in diameter, roots, or organic matter.

G. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.

H. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.

I. Doors and Frames: Remove doors, frames, and hardware where indicated. Remove anchors, shims, trim, and attachments. Leave opening ready to receive new work. Remove from site.

J. Cut existing masonry walls for new openings where indicated. Leave openings ready to receive new work or patching.

K. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes or to be infilled.

L. Mechanical, Electrical, and Structural Elements: If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict.

1. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
2. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.7 REMOVAL OF STRUCTURAL ELEMENTS

A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.

1. Interior Slabs on Grade: Employ removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.
2. Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 (150mm) inches in diameter, roots, or other organic matter.

B. Pneumatic Operated Hammers: When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote form occupied areas as possible.

1. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.

C. Saw Cutting: Locate compressors as remote as possible from occupied areas of facility.

1. Use diamond tipped saw blades and related equipment.

2. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
3. Control runoff water used with saw to prevent damage to existing materials.

3.8 ROOF REMOVAL

A. Roof Assembly: Remove existing roofing to the extent that can be covered in one day by new roofing. Maintain building interior in watertight and weathertight condition.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.

C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.

D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.

E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.

F. Remove excess residue. Thoroughly clean and remove asphalt, dust, loose materials and leave ready for new work.

3.9 PATCHING AND REPAIRS

A. Promptly repair damage to adjacent construction caused by selective demolition operations. Refinish construction or item to a condition comparable or better than before selective demolition operations or replace with new.

B. Repairs: When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials.

1. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.

C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

D. Floors and Partitions: Where walls or partitions are demolished, extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor

and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

E. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.11 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

B. Remove partitions and temporary work. Restore surfaces to match adjacent surfaces.

END OF SECTION

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.2 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

1.3 ACTION SUBMITTALS

A. Product Data: Technical data for each type of product including construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: Submit samples for each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acudor Products, Inc.
    b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    c. Larsens Manufacturing Company.
    d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    e. Nystrom, Inc.
    f. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: Indicated on Drawings.

5. Metallic Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), factory finished.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch, key operated.

B. Exterior Flush Access Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Babcock-Davis.
   b. JL Industries, Inc.; a division of the Activar Construction Products Group.
   c. Larsens Manufacturing Company.
   d. Maxam Metal Products Limited.
   e. MIFAB, Inc.
   f. Nystrom, Inc.
   g. Williams Bros. Corporation of America (The).

2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2 inch thick (50 mm thick) fiberglass insulation.
3. Locations: Wall.
4. Door Size: Indicated on Drawings.
5. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm).
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full bed plaster applications, provide zinc coated expanded metal lath and exposed casing bead welded to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.4 FINISHES

A. Comply with NAAMM 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: 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.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply lead and chromate free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply baked enamel or powder coat finish immediately after cleaning and pretreating, with minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

a. Color: Selected by Architect.

E. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Bright, Cold Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Suspension systems for interior ceilings and soffits.
2. Grid suspension systems for gypsum board ceilings.
3. Interior gypsum board.
4. Trim accessories.
5. Joint treatments.
6. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Suspension systems for interior ceilings and soffits.
2. Grid suspension systems for gypsum board ceilings.
3. Gypsum board products.
4. Trim accessories.
5. Joint treatment materials.
6. Textured finishes.

B. Samples: For the following products:

1. Textured Finishes: 12-inch- (300-mm-) square for each textured finish indicated and on same backing indicated for Work.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For embossed, high-strength steel studs and firestop tracks from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the

Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

1. Do not install interior gypsum panels and products until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

E. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.

a. Material: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.

2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Angle-Type Hangers: Angles with legs not less than 7/8-inch (22-mm) wide with a base steel thickness of 0.0538 inch (1.367 mm) and minimum 5/16-inch- (8-mm-) diameter bolted connections.

F. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 2 inches (51 mm).

G. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).
b. Depth: As indicated on Drawings.

3. Embossed, High-Strength Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: 0.0190 inch (0.483 mm).
b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: 7/8 inch (22 mm) deep.

a. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).

5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

H. Grid Suspension System for Gypsum Board Ceilings: Direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong Ceiling & Wall Solutions; Drywall Grid Systems.
b. Rockfon (Rockwool International); 640/660 Drywall Ceiling Suspension.

c. USG Corporation; Drywall Suspension System.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Georgia-Pacific Gypsum LLC.
   d. National Gypsum Company.
   e. PABCO Gypsum.
   f. USG Corporation.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047, galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized-steel sheet.

1. Edge Shapes:

   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Curved-Edge Cornerbead: With notched or flexible flanges.

2. Expansion (Control) Joints:

   a. Products: Subject to compliance with requirements, provide the following:

      1) ClarkDietrich; #93 Zinc Control Joint (ZNCJ).

2.5 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

C. Steel Drill Screws for Gypsum Board: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1) National Gypsum Company; Proform Quick Set 90 Setting Compound.
2) USG Corporation; Sheetrock Durabond 90 Setting-Type Joint Compound.

2. Fill Coat: For second coat, use setting-type, sandable topping compound.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1) National Gypsum Company; Proform Quick Set 90 Setting Compound.
2) USG Corporation; Sheetrock Durabond 90 Setting-Type Joint Compound.

3. Finish Coat: For third coat, use drying-type, all-purpose compound.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1) National Gypsum Company; Proform All Purpose Joint Compound, Ready-Mixed.
2) USG Corporation; Sheetrock Brand All Purpose Joint Compound, Ready-Mixed.

4. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1) National Gypsum Company; Proform Lite Joint Compound, Ready-Mixed.
2) USG Corporation; Sheetrock Brand Lightweight Joint Compound, Ready-Mixed.

2.7 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E84.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. USG Corporation; SHEETROCK Ceiling Spray Texture, QT.

2. Texture: Medium.

C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. National Gypsum Company; ProForm Perfect Spray.
b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

2. Texture: Light spatter.

D. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. National Gypsum Company; ProForm® Quick Set™ Lite Compound, Setting Type.
    b. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.

2. Texture: Orange peel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and support framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by ASTM C 754.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances:

1. Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
2. Where sprinkler heads, diffusers, and speakers are arranged in alignment, variation from exact alignment shall not vary more than 1/2-inch (13-mm) either side of centerline through various element openings.

3.5 INSTALLATION OF ACOUSTICAL ACCESSORIES

A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

B. Install acoustical sealant at partitions in accordance with manufacturer's instructions.

3.6 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.7 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

3.8 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Maintain fire ratings of assemblies at control joints. Install control joints according to ASTM C840 and as follows:

1. Ceilings: Install control joints:

a. no greater than 30 feet (9 m) on center and with total area not to exceed 900 sq. ft. (81 sq. m);

b. where sections of "A," "L," "O," "U," "T," and "X" shaped ceiling areas or furr-down areas intersect;
c. at other locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use where indicated on Drawings.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where edge trim can only be installed after gypsum board is installed.
5. U-Bead: Use at exposed panel edges not intended to receive joint compound.
6. Curved-Edge Cornerbead: Use at curved openings.

3.9 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels:

1. Level 0: No taping, finishing, or accessories required.
2. Level 1:

a. Joints: Tape set in joint compound.
b. Interior Angles: Tape set in joint compound.
c. Surface: Tool marks and ridges acceptable. Surface free of excess joint compound.

3. Level 2:

a. Joints: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
b. Interior Angles: Tape embedded in joint compound and wiped with a joint knife, leaving a thin coat of compound over tape.
c. Accessories: Shall be covered to one separate coat of joint compound.
d. Fasteners: Shall be covered by one separate coat of joint compound.
e. Surface: Surface shall be free of excess joint compound. Tool marks and ridges acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

4. Level 3:

    a. Joints: Taped as in Level 2, then covered with one separate coat of joint compound.
    b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
    c. Accessories: Shall be covered by two separate coats of joint compound.
    d. Fasteners: Shall be covered by two separate coats of joint compound.
    e. Surface: Joint compound shall be smooth and free of tool marks and ridges.

5. Level 4:

    a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
    b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
    c. Accessories: Shall be covered by three separate coats of joint compound.
    d. Fasteners: Shall be covered by three separate coats of joint compound.
    e. Surface: Joint compound shall be smooth and free of tool marks and ridges.

6. Level 5:

    a. Joints: Taped as in Level 2, then covered with two separate coats of joint compound.
    b. Interior Angles: Taped as in Level 2, then covered with one separate coat of joint compound.
    c. Accessories: Shall be covered by three separate coats of joint compound.
    d. Fasteners: Shall be covered by three separate coats of joint compound.
    e. Surface: A thin skin coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

E. Gypsum Board Finish Level Schedule: Finish panels to levels indicated below and according to ASTM C840:

1. Level 0: Not used.
2. Level 1: Ceiling plenum areas, concealed areas, service corridors and other areas not normally exposed to view.
3. Level 2: Panels that are substrates for tile.
4. Level 3: Not used.
5. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

6. Level 5: Not used.

3.10 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.11 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and application of interior paint coating systems on interior substrates.

B. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following shop- and factory-finished components:

a. Architectural woodwork and casework.
b. Metal lockers.
c. Prefinished elevator entrance doors and frames.
d. Elevator equipment.
e. Finished mechanical and electrical equipment.
f. Light fixtures.
g. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Furred areas.
b. Ceiling plenums.
c. Pipe spaces.
d. Duct shafts.
e. Elevator shafts.

3. Finished metal surfaces include the following:

a. Door hardware.
b. Aluminum.
c. Brass.
d. Bronze.
e. Chromium plate.
f. Copper.
g. Nickel.
h. Stainless steel.

4. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

5. Operating parts including moving parts of operating equipment and the following:

    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.

1.2 DEFINITIONS

A. Gloss Factors: Values of various degrees of luster when tested in accordance with ASTM D523 shall comply with following:

1. Gloss Level 1 – Flat: Not more than five units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2 – Low Sheen: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3 – Eggshell: 1 0 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4 – Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5 – Semigloss: 35 to 70 units at 60 degrees.
6. Gloss Level 6 – Gloss: 70 to 85 units at 60 degrees.
7. Gloss Level 7 – High Gloss: More than 85 units at 60 degrees.

1.3 COORDINATION

A. Coordination of Work: Review other sections of the specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, for compatibility between prime and finish coats.

1.4 ACTION SUBMITTALS

A. Product Data: Technical data and product information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, surface preparation, and application for each paint and coating system.

1. For field painting of factory primed metal products and fabrications, submit technical data for each type of paint product, surface preparation requirements, and application instructions.
2. Indicate manufacturer's instructions for special surface preparation procedures and substrate conditions requiring special attention.
3. Product List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coatings, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification. Use same designations indicated in Finish Schedules.

B. Samples: Submit aged (minimum seven day old) paint samples for each type of paint system and each color and gloss of topcoat.

1. Provide stepped draw-down samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

a. Label draw-down samples with the following:

1) Paint manufacturer.
2) Manufacturer's color name, number, and sheen.
3) Paint formula employed to produce designated color and sheen.
4) Date paint was mixed.

2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
3. Submit samples on substrates for review of color and texture:

a. Ferrous and Nonferrous Metals: Two 4 inch (100 mm) square samples of flat metal and two 8 inch (200 mm) long samples of solid metal for each color and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For applicator.

B. Quality Control Submittals: Furnish certificates from manufacturer that products supplied comply with VOC content limits and emission in accordance with local, state, and federal regulations and sustainability limit requirements.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to lead and mercury. Do not use solvents in paint products that contribute to air pollution.

B. Applicator Qualifications: Entity having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Single Source Responsibility: Provide block fillers, primers and other undercoat paint produced by same manufacturer as finish coats.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Container Labels: Include manufacturer's name, type of paint, brand name, lot number and date of manufacturer, brand code, coverage rate, surface preparation, instructions for mixing and reducing drying time, cleanup requirements, color designation, and application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Do not thin or add water to waterbased paints, including waterbased alkyds.

B. Weather Conditions:

1. Apply paints when temperature of surfaces to be painted and ambient air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
3. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (35 degrees C) for exterior, unless otherwise indicated by manufacturer’s Product Data Sheet.

C. Apply solvent thinned paints when temperatures of surfaces to receive paint and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).

1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

D. Painting may continue during inclement weather if surfaces and areas to receive paint and coatings are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80 foot-candles (860 lx) measured mid-height at substrate surface.

1.9 SURPLUS MATERIALS

A. Inquire and coordinate with Owner regarding disposition of excess and leftover paint materials. If Owner wishes to retain excess materials for maintenance and touch-up purposes, deliver excess materials to designated storage area as directed by Owner.

1. Any materials not retained by Owner shall become the property of the Contractor and shall be removed from the site.

PART 2 - PRODUCTS

A. Acceptable Manufacturers: Provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential-grade products are not permitted.

1. Benjamin Moore & Co. (BM).
2. The Pittsburgh Paints Company / PPG Paints (PPC).
3. The Sherwin-Williams Company (S-W).

2.2 PERFORMANCE REQUIREMENTS

A. Performance and Durability:

1. ASTM D16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
2. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
3. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
4. ASTM D4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Chemical Components of Field Applied Interior Paints and Coatings: Provide topcoat paints and anticorrosive and antirust paints applied to ferrous metals that comply with

chemical restrictions; these requirements do not apply to paints and coatings applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain components restricted by the EPA.

2.3 MATERIALS

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Accessories: Linseed oil, shellac, turpentine, paint thinners, and similar materials not specifically indicated but necessary to achieve the finishes specified for commercial quality.

C. Patching Materials: Latex filler compatible with paint systems.

D. Fastener Head Cover Materials: Latex filler.

E. Colors: As indicated in Finish Schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify joints are properly taped and finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint or coating system consisting of primer and two top coats at a minimum.

    a. When previously painted surfaces have failed to accept new paint systems, determine cause of failure and take corrective measures to ensure each surface accepts new paint or coating system. Failure of new paint system is not permitted.

2. Shop Primed Metals: Inspect shop primed metals to determine if primer is in condition to receive and is compatible with topcoats.

E. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator’s acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Coordination of Work:

1. Preprimed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or preprimed substrates.
2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
3. Repair defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
4. Seal marks which may bleed through surface finishes.
5. Touch up shop primer or previously painted surfaces prior to application of topcoats.

C. Surface Cleaning and Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition.

D. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting

1. Before applying paint or surface treatments, clean substrates of substances that impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
2. Remove hardware, covers, plates, and similar items in place that are removable and are not to be painted. If removal is impractical or impossible because of size

or weight of item, provide surface applied protection before surface preparation and painting.

a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection.

3. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
4. Seal marks which may bleed through surface finishes with shellac.
5. Provide barrier coats over incompatible primers or remove and reprime.
6. Correct defects and clean surfaces which affect the Work.
7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

E. Ferrous Metals: Remove rust, loose mill scale, and shop primer. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

1. SSPC-SP 11.

F. Shop Primed Ferrous Metal Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.

1. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
2. Touch up bare areas and damaged shop applied prime coats. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

G. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Aluminum Substrates: Remove surface oxidation with acid etch and solvent washing. Remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP-1 Solvent Cleaning. Apply etching primer immediately following cleaning.

I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

K. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach.

If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

L. Protective Coverings: Provide protections for duration of the Work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

M. Renovated Surfaces: Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system.

1. Remove surface film preventing proper adhesion and bond.
2. Wash glossy paint with a solution of salt soda and rinse thoroughly.
3. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
4. Clean corroded iron and steel surfaces.
5. Repair and blend into portland cement plaster.
6. Prime bare surfaces.
7. Tone varnished surfaces with stain bringing to uniform color.
8. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Pipe Covering and Insulation: Remove loose, foreign, and objectionable material before applying sealing coat.

P. Preparation of Substrates for Wallcovering: Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate.

1. Assure compatibility with product of wall covering manufacturer.
2. Fill indentations in substrate and prime with opaque white primer before applying release coat.
3. Apply release coat in accordance with manufacturer's recommendations.

Q. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

R. Paint and Coating Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Do not use thinners for water based paints.
4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat. Provide sufficient differences in shade of undercoats to distinguish each separate coat.

S. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

T. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

U. Wood and Metal Doors: Seal top and bottom edges with primer.

3.3 APPLICATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

1. The term exposed surfaces includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
2. Provide finish coats compatible with primers.
3. Use applicators and techniques suited for paint and substrate indicated.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.

    a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
    b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
    c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
    d. Finish doors on tops, bottoms, and side edges the same as exterior faces.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
8. rating, or nomenclature plates.

9. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
10. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
11. Paint entire exposed surface of window frames and sashes.
12. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
13. Sand lightly between each succeeding enamel or varnish coat.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Minimum Coating Thickness: Apply paint materials to dry film thickness indicated in pain schedule but no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

F. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
4. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
5. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
6. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.
7. Paint the following work where exposed to view:

    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or paintable jacket material.

8. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.

9. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

H. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

I. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating.

1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.

J. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

K. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.

1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
2. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

M. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.

1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 WASTE MANAGEMENT

A. Paint products are considered hazardous materials. Do not empty or allow excess paint to enter storm drainage systems. Comply with manufacturer's written instructions for disposal of leftover paint and paint buckets.

B. Waste Disposal: Legally dispose of metal, plastic, and product waste, including accessories and used items, by recycling or reusing waste materials.

C. Clean and recycle plastic paint containers. Do not dispose of paint containers in landfills.

D. Do not dispose of unused paints, stains, and coatings by pouring into storm drainage or sewer systems.

E. Do not allow run off water resulting from washing paint containers and applicators to seep into the ground or run into the storm drainage or sewer systems.

1. Prior to disposing, allow unused paint to dry in can before legally disposing.

F. Legally dispose of unused paint, stain, and coatings and the containers in accordance with manufacturer’s recommendations and environmental regulations.

3.6 CLEANING AND PROTECTION

A. Clean Up: At end of each day, remove rubbish, empty cans, rags, and other discarded materials from site. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

B. Protections: 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.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

D. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.

E. Provide Wet Paint signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related Work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 INTERIOR PAINT AND COATING SCHEDULE

A. Ceiling Gypsum Board:

1. Finish: Lusterless (flat) latex; primer and two finish coats.
2. Primer: No Substitutions.

    a. BM: Ultra Spec 500 Waterborne Interior Primer Sealer N534, (0 g/L VOC), 1.8 mils dry minimum.
    b. PPC: Speedhide Interior Latex Primer Sealer 6-2, (<50 g/L VOC), 1.0 mils dry minimum.
    c. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W12600 (0 G/L VOC), 1.0 mils dry minimum.

3. Finish Coats:

    a. BM: Waterborne Ceiling Paint, Flat, 0 VOC, 508, 1.4 mils dry per coat
    b. PPC: 6-4110XI Speedhide zero Interior Flat Latex (0 g/L VOC), 1.8 mils dry per coat minimum.
    c. S-W: ProMar 200 Zero VOC Interior Flat Paint B30 Series (0 G/L VOC), 1.4 mils dry per coat minimum.

B. Gypsum Board:

1. Finish: Satin latex enamel; primer and two finish coats.
2. Primer: No Substitutions.

    a. BM: Eco Spec WB Interior Latex Primer N372/F372 (<51 g/L VOC)
    b. PPC: Speedhide Interior Latex Primer Sealer 6-2, (<50 g/L VOC), 1.0 mils dry minimum.
    c. S-W: ProMar 200 Zero VOC Interior Latex Primer B28W2600 (0 G/L VOC), 1.0 mils dry minimum.

3. Finish Coats:

    a. BM: Premium Interior Latex Eggshell W626/K626 (<51 g/L VOC)
    b. PPC: 6-411 Series Speedhide Interior Enamel Eggshell Latex (73 g/L VOC), 1.5 – 1.7 mils dry per coat.
    c. S-W: ProMar 200 Zero VOC Interior Eg-shel Paint B20 Series (0 G/L VOC), 1.7 mils dry per coat minimum.

C. Ferrous Metal - Galvanized:

1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
2. Primer:

    a. BM: 363 IronClad Latex Low Lustre Metal & Wood Enamel (<150 g/L VOC), 1.6 mils dry minimum.
    b. PPC: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dry.
    c. S-W: Pro Industrial Pro-Cryl Univeral Acrylic Primer B661300 Series (<100 g/L VOC), 2.0 – 3.8 mils dry.

3. Finish Coats:

    a. BM: 276 Moorcraft Super Spec Latex Semi-Gloss Enamel (<150 g/L VOC), 1.2 mils dry per coat minimum.
    b. PPC: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (90 g/L VOC), 1.5 – 1.7 mild dry per coat.
    c. S-W: S-W: Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.2 to 4.3 mils (0.064 to 0.102 mm) dry, per coat.

D. Ferrous Metal – Not listed above:

1. Finish: Semi-Gloss latex enamel; primer and two finish coats.
2. Primer:

    a. BM: 363 IronClad Latex Low Lustre Metal & Wood Enamel (<150 g/L VOC), 1.6 mils dry minimum.
    b. PPC: 90-712 Series Pitt-Tech Interior/Exterior Primer/Finish DTM Industrial Enamel (123 g/L VOC), 2.0 – 3.0 mils dry.
    c. S-W: Pro Industrial Pro-Cryl Univeral Acrylic Primer B661300 Series (<100 g/L VOC), 2.0 – 3.8 mils dry.

3. Finish Coats:

    a. BM: 276 Moorcraft Super Spec Latex Semi-Gloss Enamel (< 150 g/L), 1.2 mils dry per coat minimum.
    b. PPC: 6-500 Series Speedhide Interior Semi-Gloss Acrylic Latex (90 g/L VOC), 1.5 – 1.7 mild dry per coat.
    c. S-W: Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.2 to 4.3 mils (0.064 to 0.102 mm) dry, per coat.

E. Exposed Deck Applications: Do not include walls.

1. Dry-Fall, Flat:

    a. PPC: Speedhide Super Tech WB Interior Dry-Fog Flat Latex 6-723XI, 6-725XI, 2.4 mils DRY.
    b. S-W: Pro Industrial Waterborne Acrylic Dryfall Flat, B42-2181 Series, at 6.0 mils (0.152 mm) wet, 1.9 mils (0.038 mm) dry.

END OF SECTION

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SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

1. Associated Air Balance Council
2. American Boiler Manufacturers Association
3. Air Diffusion Council
4. American Gas Association
5. American Institute of Architects
6. Air Movement and Control Association
7. American National Standards Institute
8. Air-Conditioning and Refrigeration Institute
9. American Society of Heating, Refrigerating and Air Conditioning Eng.
10. American Society of Mechanical Engineers
11. American Society for Testing and Materials
12. American Water Works Association
13. American Welding Society
14. Compressed Gas Association
15. Cooling Tower Institute
16. Environmental Protection Agency
17. Factory Mutual
18. International Cable Engineers Association
19. Institute of Electrical and Electronics Engineers
20. Illuminating Engineering Society of North America
21. Industrial Risk Insurance
22. Instrument Society of America
23. Mechanical Contractors Association
24. Midwest Insulation Contractors Association
25. Manufacturer’s Standardization Society of the Valve & Fitting Industry
26. National Bureau of Fire Underwriters
27. National Bureau of Standards
28. National Environmental Balancing Bureau
29. National Electric Code
30. National Electrical Manufacturers Association
31. National Fire Protection Association
32. National Safety Council

33. Occupational Safety and Health Administration
34. Plumbing and Drainage Institute
35. Sheet Metal and Air Conditioning Contractors' National Association
36. Underwriters Laboratories
37. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
38. ASTM E84 Standard Test Method for Surface Burning Characteristics of Bldg. Materials
39. Fire Tests of Through-Penetration Firestops
40. Surface Burning Characteristics of Building Materials

1.03 SUMMARY

A. This Section includes the following:

1. Definitions
2. Submittals
3. Extra Materials
4. Codes and permits
5. Authority having jurisdiction inspections
6. Insurance
7. Commissioning and testing
8. Guarantee / Warranty
9. Quality Assurance
10. Delivery, storage and handling
11. Coordination
12. Cutting and patching
13. Access panels in walls and ceilings
14. System description
15. Existing conditions
16. Continuity of services and use of facility
17. Maintenance
18. Manufacturers
19. Access doors and frames for walls and ceilings
20. Pipe, tube, and fittings
21. Grout
22. Pipe escutcheons
23. Fire-suppression demolition
24. Material and workmanship
25. Equipment
26. Piping systems – common requirements
27. Piping joint construction
28. Pipe connections
29. Painting and touch up
30. Concrete bases
31. Erection of metal supports and anchorages
32. Erection of wood supports and anchorages

33. Grouting
34. Excavation and backfill
35. Protection and cleaning
36. Training
37. Building commissioning
38. Interruption of existing fire suppression service
39. Start-up
40. Testing, adjusting and balancing
41. Final field observation
42. Date of project completion

1.04 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

H. Basic Contract definitions are as follows:

1. Provide: The term "provide" means "to furnish and install, ready for the intended use and in complete operating condition."
2. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

3. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
4. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contracts.
5. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
6. Contractor: The term "Contractor" shall carry the same meaning as "Fire Suppression Contractor" or “Division 21 Contractor”.
7. Or Equal: The term "Or equal" shall carry the same meaning as "approved as equal by the Engineer"
8. Supplied: The term “supplied” shall carry the same meaning of provided.
9. Others: The term refers to another entity or another contractor other than the “Fire Suppression Contractor or “Division 21 Contractor”

10. Owner: All references here-in and on drawings to “Owner” shall be the same as “Rockwall ISD”.
11. Contract Documents: References to Contract Documents refers to a complete set of Drawings and Specifications for the entire Project. Drawings and Specifications are intended to supplement one another.
12. Dimensions: Arrangement of equipment, accessories, piping and ductwork on the Drawings is generally diagrammatic unless the Drawings include dimensions. Do not scale the Drawings. Field verify all dimensions at the site to locate new and existing work.
13. Furnish: To obtain, coordinate, submit the necessary drawings, deliver to the job site in new condition ready for installation, unload and unpack, and guarantee.
14. Responsibility: Where verbs such as “furnish”, “provide”, “install”, or “use” appear in the Contract Documents, they mean, “The Fire Protection Contractor shall furnish, provide, install, or use…..” unless the requirement is introduced by a phrase, sentence or heading specifically identifying the requirement as the responsibility of someone else.

1.05 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Sections.

B. Substitutions:

1. Submittal dates: For a period of up to ten (10) days prior to bid date, Engineer will consider written requests from bidders, manufacturers, and suppliers for substitution of products.
2. Submission: Submit a separate request for each product, supported with descriptions, drawings and samples as appropriate, including:

a. Comparison of the qualities of the proposed substitution with that specified. Standard features and options of the proposed substitution shall be clearly identified on the submittal.
b. Changes required in other elements of the work because of the substitution.
c. Availability of maintenance service, and source of replacement materials.

3. Substitution request constitutes a representation that bidder submitting request:

a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
b. Will provide the same warranties or bonds for the substitution as for the product specified.
c. Will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects.
d. Waives all claims for additional costs, under his responsibility which may subsequently become apparent.

4. Engineer Review: The Engineer will review requests for substitutions with reasonable promptness to judge the acceptability of the proposed substitution, and notify bidders by addendum the decision to accept the requested substitution. Substitution requests not indicated in addendums are considered rejected and not allowed.
5. Late Request for Substitutions: Requests for substitution received after bidding will not be considered except in such cases where it is necessary to make a substitution due to strikes, lockouts, bankruptcy, discontinuing of a product, etc. Requests for such substitutions of materials after award of contract shall be made in writing to Engineer and shall be made within ten days of date that Contractor ascertains he cannot obtain material or equipment specified.
6. Engineer’s Acceptance: Engineer's acceptance of a substituted item applies only to the general quality and arrangement of the items substituted. Substituted items are still subject to compliance with the specification requirements and the shop drawing review process.
7. Cost Adjustment: Contractor to bear all added costs associated with substituted items, including costs incurred by other contractors. Cost savings associated with substitutions shall be refunded to the Owner.
8. Contractor is responsible for dimensional differences, weights, electrical requirements and any other resulting changes, when using equipment other than that scheduled on the Drawings. Contractor is responsible for any additional costs incurred as a result of substitutions, including other Contractors and Architect/Engineer fees.
9. Material and equipment not listed in the Specifications nor accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner.

C. Shop Drawings:

1. Before ordering any equipment, review and stamp with submitting contractor approval, and submit electronically to the Architect/Engineer for review.
2. The review of shop drawings by the Architect/Engineer shall not constitute agreement of any deviations from the plans and specifications and shall not relieve the Contractor from responsibility for errors or omissions.
3. Submit all shop drawings a maximum of 1 month from date of contract award.
4. Shop drawings shall be in electronic copy format as follows:

    a. All shop drawings shall bear the submitting contractors approval stamp.
    b. Electronic copies (digital copies) of shop drawings shall be in Adobe Acrobat Portable Document Format - *.pdf format.

5. Submit for all equipment and systems as indicated in the respective specifications sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
6. Include project name, name of Architect, name of Engineer, contractor, sub-contractor, manufacturer, supplier and sales representative, include name, address, and phone number for the sales representative. Clearly identify section number and description of equipment submitted.
7. Examine all shop drawings noting capacity, arrangement and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information. Review and stamp shop drawing prior to submitting to the Engineer.
8. Before submitting electrically powered equipment, verify that the electrical power and control requirement for the equipment are in agreement with the schedules on the drawings. Include a statement of the shop drawing transmittal to the Architect/Engineer that the equipment submitted and the schedules are in agreement or indicate any discrepancies.
9. Refer to drawings and specifications for the additional required equipment that is to be submitted as part of the shop drawing submittals.
10. All shop drawings must be reviewed and accepted by the Engineer prior to fabrication and installation.
11. Submittals will be reviewed with the following actions:

    a. NO EXCEPTIONS TAKEN - Indicates the Submittal appears to conform to the design concept of the Work and that the Contractor at his discretion, may proceed with fabrication and/or procurement and installation.
    b. NOTE MARKING - Indicates that the Submittals, after noted corrections are made, would appear to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
    c. REVISE AND RESUBMIT - Indicates that the Submittal does not appear to conform to the specifications, and that the submittal needs to be changed to

reflect the items noted. The Contractor shall not proceed with fabrication or procurement.

d. REJECTED - Indicates that the Submittal does not appear to conform to the specifications, and that a complete resubmittal is required. The Contractor shall not proceed with fabrication or procurement.
e. SEE ATTACHED COMMENTS - Indicates that the Submittals, after attached comments are made, would appear to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
f. Allow a minimum of fourteen (14) calendar days for the Engineer to review the shop drawings. Time is from the receipt of drawings in the Engineers office until they are shipped out of the office.

D. Payment Request Breakdown:

1. For the purpose of establishing a schedule of values to be used for Application and Certification for Payments as defined in the General Conditions of the specifications, the items of fire suppression work shall be broken down. Each item of schedule shall contain its proper share of overhead and profit and shall be broken into a labor and material figure.
2. Submit the schedule of values to the engineer prior to first payment request.

E. Project Record Documents:

1. As work progresses: Record changes or deviations from the contract drawings as follows:

a. Record location and elevation of underground buried piping.
b. Record as-built changes for fire suppression work within the building that occur during the progress of construction and before the work is concealed. Record shall include such changes as:

1) Relocation of valves or piping to avoid obstacles.
2) Routing of piping overhead, in walls or exposed.
3) Locations of sprinkler heads.
4) Sizes of piping.
5) Revisions to hydraulic calculations reflecting as-built conditions.

2. Location: The record drawings shall be maintained at the job site and be subject to review by the Owner or Engineer during the construction period. Prints for this purpose may be obtained from the Architect at cost. This record keeping requirement shall not be construed as authorization for the Contractor to make changes in the layout without definite instructions by the Architect/Engineer in each case.

3. Submission: Upon completion of the work, a set of drawings showing changes as noted on the record set of prints shall be submitted to the [Engineer] [Construction Manager].

F. Operating and Maintenance Manuals:

1. Submittal: At the completion of the contract submit to the Owner one digital copy of operating and maintenance manuals with folder structure and naming including parts lists for the division 21 equipment, systems, and materials. Digital copies shall be in Adobe Acrobat Portable Document Format - *.pdf format. Information not definitely applying to these particular pieces of equipment shall be crossed out or deleted from the submission. Information shall be included for equipment for which shop drawings have been provided.
2. All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 General Requirements.

    a. Approved shop drawings or product data sheets alone are not to be considered as acceptable maintenance material.
    b. In addition to the data indicated in the General Requirements, include the following information:

        1) Copies of all approved shop drawings
        2) Installation manuals
        3) Manufacturer’s wiring diagrams for electrically powered equipment.
        4) Records of tests performed to certify compliance with system requirements.
        5) Certificates of inspection by regulatory agencies
        6) Parts lists for manufactured equipment
        7) Valve schedules
        8) Lubrication instructions, including list/frequency of lubrication done during construction
        9) Warranties
        10) Additional information as indicated in the technical specification section.
        11) Operating instruction for equipment
        12) Recommended maintenance schedules and procedures for equipment
        13) Recommended trouble shooting procedures for equipment
        14) Settings/adjustments/calibrations for systems as required
        15) Local equipment suppliers/reps names, addresses, and telephone numbers
        16) Equipment manufacturers names, addresses, and telephone numbers
        17) Sub-contractors names, addresses, and telephone numbers
        18) Test reports
        19) Statement from Contractor that all incomplete items noted in Engineer’s Final Field Observation Report have been completed
        20) Statement from Owner confirming completion of Training
        21) Refer to individual Specification Sections in for additional requirements

c. Special warranties.

G. Hazardous Materials: Disposal Certificates.

H. Welding certificates.

1.06 EXTRA MATERIALS

A. Refer to individual Specification Sections for extra materials to be provided to the Owner.

1.07 CODES AND PERMITS

A. The fire suppression system shall be designed and installed in compliance with state code, local code and National Fire Protection Association Codes (NFPA) for fire suppression systems.

B. Obtain and pay fees for all licenses, required permits, and charges for use of outside services (i.e. inspecting agencies or delivery services) and use of property other than the site of the Work for storage of materials or other purposes.

C. Regular inspections shall be arranged by the Contractor as required by any and all regulations. All charges for inspections by regulating agencies of installations or review of plans and specifications shall be paid by the Contractor.

1.08 AUTHORITY HAVING JURISDICTION INSPECTIONS

A. Secure regular inspections as required by State and local regulations. Pay charges by regulating agencies for Drawings, Specifications, review of Drawings and Specifications, and the inspections of installations.

1.09 INSURANCE

A. Procure and maintain such insurance required by law and additional insurance as specified in Division 0 or 1 or as required by the general contractor.

1.10 COMMISSIONING AND TESTING:

A. Provide field Commissioning and testing of fire pumps as defined in Sections 213113, 213213 and 213400.

1.11 GUARANTEE/WARRANTY

A. The fire suppression system installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year unless a longer period is specified elsewhere, from [substantial completion][date of acceptance by the Owner] [beneficial use by the Owner], except materials not furnished by the Contractor.

B. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished on special equipment, indicated.

1.12 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. All drawings, specifications and documents for this project shall be taken as a whole. Prior to installation, the Contractor shall be familiar with this project by carefully reviewing and comparing all documents that pertain to this project.

D. In preparation of the contract documents, a reasonable effort has been made to provide layouts and connections based on selected and specified manufacturer's equipment. Since physical space, electrical connections, equipment arrangements and other requirements may vary according to each manufacturer, the final responsibility for connections, initial access and proper fit is the responsibility of the Contractor.

E. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the fire - suppression installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
2. Sleeves through fire rated floors and walls shall be non-combustible.

F. Sequence, coordinate, and integrate installing fire-suppression materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

G. Electrical Characteristics for Fire-Suppression Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

H. Regulatory Requirements: Compliance with the current adopted version of the applicable national, state, and local codes and referenced industry standards and specifications including:

1. American Society of Mechanical Engineers Unfired Pressure Vessel Code
2. American National Standards Institute (ANSI)
3. Americans with Disabilities Act
4. FGI Guidelines for Healthcare Facilities
5. Municipal Water and Sewer Regulations
6. National Electrical Code (NEC)
7. National Fire Protection Association Codes (NFPA)
8. Occupational Safety and Health Administration (OSHA)
9. State and Local Building Codes
10. State and Local Electrical Codes
11. State and Local Fire Codes and Regulations
12. State and Local Mechanical Codes
13. State and Local Plumbing Codes
14. State Industrial Commission Regulations
15. State Elevator Code
16. State Energy Code
17. Uniform Federal Accessibility Standards

18. [Universities Code Offices are to be the Authority Having Jurisdiction.]
19. Meet or exceed all current applicable codes, ordinances and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations.
20. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.

I. Agency Approvals: Demonstrated by seal, label, or stamp whenever these Specifications, referenced standards, or regulatory agencies require materials and equipment to conform to requirements of an inspection and testing agencies.

J. Standard for Materials and Workmanship: New materials, free of defects, installed in accordance with manufacturer's current published recommendations, in neat manner, and in accordance with recognized standard industry practice.

K. Equipment Nameplates: Permanently attached to each major equipment component including manufacturer's name, model and serial numbers, and address.

L. Noise and Vibration: Limited to levels not objectionable to occupants and not detrimental to Owner operations, by balancing rotating and reciprocating equipment, and use of vibration isolating and noise abating products and installation procedures.

M. Layout of Work:

1. Install equipment and run pipes parallel with and at right angles to lines of building unless shown otherwise on Drawings.
2. Lay out Work and be responsible for lines, elevations and measurements required for installation. No additional compensation will be provided for lack of coordination and installation.

3. Offset piping as required for coordination and installation of work.
4. Prepare coordination drawings for ductwork, piping, and equipment.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.14 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, sprinklers installed in/on architectural surfaces.

D. Coordinate work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor’s work shall be removed or relocated at the installing contractor’s expense.

E. Submit to the Architect/Engineer coordination drawings indicating that the fire suppression work has been coordinated with other trades.

1.15 CUTTING AND PATCHING

A. Each trade shall perform all cutting and patching necessary in order to perform his work unless such work has been delegated to the General Contractor. However, special permission shall be obtained from the Engineer before cutting structural members or finished material. All patching shall be performed in such manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by persons experienced, skilled and licensed for the particular type of work involved. Inferior work will not be accepted. Pipe penetration through new or existing floors and walls, regardless of type of construction, should be done by rotary drill, wet or dry method. Use of a pneumatic impact tool is not acceptable. Contractor to contain water and dust to avoid damage to adjacent finishes, furniture and equipment.

B. Pavements, sidewalks, roads and curbs shall be cut, patched, repaired and replaced as required to permit the installation of the work of each trade. Such cutting, patching, repairing and replacing shall be the responsibility of and paid for by the trade requiring the work.

C. Each trade shall bear the expense of all cutting, patching, repairing, or replacing of the work of other trades required because of his fault, error, or tardiness or because of any damage done by him.

D. Holes Through Masonry and Concrete:

1. Each trade shall provide all holes and openings required for his work unless such holes and openings are shown to be provided on the architectural or structural drawings. Pay particular attention to openings required in pre-cast, pre-stressed, or post-tensioned slabs.
2. Holes made in the field shall be core drilled large enough to allow all pipe insulation to continue uninterrupted. Holes in floors or exterior walls above grade shall include a steel pipe sleeve grouted watertight.

    a. The above method shall be employed whenever holes are made on the job including holes required by change orders or because of omissions made inadvertently by the trade.

3. Pipe openings in exterior walls below grade between earth areas and interior spaces shall include a steel pipe sleeve and a mechanical seal.
4. Each trade shall be responsible for providing and disposing of water he uses in the core drilling operation. Such work shall be scheduled and other trades coordinated so that damage will not result from the use of water.
5. Each trade shall be responsible for grouting air-tight any openings adjacent to his work to seal against the passage of air, smoke vapors or sound.

E. Entry of Equipment

1. Make all provisions for the entry of equipment provided under contract to the indicated locations. Provide all openings in the building, if necessary, and do all excavating, backfilling and repair necessary.
2. Break down equipment as required to allow entry of equipment into the building.

1.16 ACCESS PANELS IN WALLS AND CEILINGS

A. Access panels shall be furnished by the trade requiring them and delivered to the General Contractor for installation by them. Provide anticipated quantity of access panels required to the General Contractor at time of bidding. Coordinate size and location of installation to allow for proper access.

B. [Panels shall be as specified in Division 08.

1. Door Size: As required for access to mechanical item located behind
2. Fire-Resistance Rating to be not less than that of adjacent construction.]

C. [Panels shall be as specified in part 2:

1. Door Size: As required for access to mechanical item located behind

2. Fire-Resistance Rating to be not less than that of adjacent construction.]

D. Access Panel Locations:

1. Access shall be provided to any type of valve, manual vent etc. that requires adjustment, replacement, or visual inspection.
2. Each trade shall consult with the General Contractor to coordinate the location of each access panel.
3. Generally, access panels are not required when a lay-in-ceiling is installed. However, depending on the type of occupancy, the Engineer may require that access areas be identified.

1.17 SYSTEM DESCRIPTION

A. Design Requirements:

1. Division 21, 22, and 23 Specifications and Drawings are complementary and together define scope of Work for mechanical systems.

a. Indicated Work includes furnishing all labor, material and equipment, which is necessary for successful operation of all mechanical systems as shown on drawings and as specified, except as such items as are specifically noted as being furnished under other sections of specifications.
b. Drawings and specifications are to be considered as supplementing each other. Work specified but not shown on drawings, or shown on drawings but not specified, shall be performed or furnished as though mentioned in both specifications and drawings. If not otherwise directed, installation of all systems and equipment shall be in accordance with applicable codes and in accordance with manufacturer’s installation instructions. Where work described in the specifications is in conflict with the work shown on the drawings, the contractor shall supply the greater quantity, quality and cost via the bid and contact the Engineer for clarification on direction prior to installation.
c. Accessories or devices reasonably inferable as necessary for completion and proper operation of any system shall be provided by contractor or subcontractor for such system whether or not specifically called for by specifications or drawings.

2. Drawings are diagrammatic and are not intended to be scaled. Drawings are a graphic representation of contract requirements, produced according to best available standards to an optimum scale. Dimensions of work as indicated on plans are not guaranteed to be as-built dimensions. No measurements shall be scaled from drawings and used as a definite dimension for layout or fitting work in place.
3. Offsets, Fittings, and Accessories are not shown when precluded by Drawing production techniques or scales. Provide accessories and offset fittings required for completed installation of fully functioning and coordinating systems.

4. Clarifications: Requested from Engineer prior to bidding when Contractor is uncertain of requirements.

B. Performance Requirements:

1. Dimensions: Taken from Architectural and Structural Drawings, certified equipment drawings and from structure itself before fabricating Work.
2. Space Requirements: Verified and coordinated with other trades prior to fabrication and installation of Work. Give consideration to work by all contractors associated with the project and organize the work so that it will not interfere with work of other trades. Consult the drawings and specifications for work to be provided by other trades for correlating information, and the architectural and structural drawings for details, dimensions, foundations, pits, etc. The contractor shall verify all dimensions and conditions before starting their work.
3. Manufactured material specified or shown on drawings shall be installed or applied according to manufacturers' directions unless specifically designated otherwise.

1.18 EXISTING CONDITIONS

A. Visit premises and determine existing conditions before submitting a proposal or bid.

B. Before submitting a proposal or bid on the work outlined in this specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize themselves with all the existing conditions and limitations. No additional compensation will be allowed because of the Contractor's misunderstanding as to the amount of work involved or his lack of knowledge of any site conditions that may affect his work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum. Additional compensation will not be authorized because of conditions determinable prior to bidding without excavation, demolition, or precise measurement.

C. The existence of any wires, conduits, pipes, ducts, or other facilities are shown in a general way only. It will be the responsibility of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to the submission of his bid. It is understood that he will be responsible for making the exact determination of the location and condition of such facilities.

D. The location and routing of new systems and equipment shall be coordinated by the subcontractor with the mechanical, plumbing, fire protection, electrical and communication systems existing within the building. The subcontractor shall conduct a complete and detailed field survey prior to locating and installing new electrical services included in this contract. The routing and location of all new mechanical, plumbing and fire protection system services shall be approved by the Owner prior to installation.

1.19 CONTINUITY OF SERVICES AND USE OF FACILITY

A. The building will be in use during these operations, and each trade shall schedule his work and carry it out in such a manner as to least inconvenience the occupants due to interruption of fire suppression services. Interruptions shall be confined to the smallest area possible at any one time and all interruptions shall be approved by the Owner. Temporary connections shall be made if required to provide continuity of service.

1. Procedures for Interruption of Owner's Operations:

a. Permission: Obtained from Owner before disruption of existing facility occurs.
b. Scheduled: Between the hours of [6 PM and 6 AM] unless otherwise approved by Owner.
c. Duration: Limited to time periods approved by Owner by assigning adequate sized crews and using overtime compensation as required.

B. After service has been restored following an interruption, each trade shall inspect all areas affected by the interruptions and be responsible for returning all services to the same operating condition which existed prior to the interruption.

C. The normal use of the facility shall not be disturbed, except within the immediate construction area. All walks, driveways and entrances shall be kept clear and free of all Contractors' equipment, material and debris at all times.

1.20 MAINTENANCE

A. Maintenance Service: During warranty period for defective workmanship and material.

1. Emergency Service: Provide immediate, 24-hour response.
2. Normal Service: Non-emergency service may be performed during normal working hours.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers:

1. Access Panel Solutions.
2. Acudor Products, Inc.

3. Alfab, Inc.
4. Babcock-Davis.
5. Cendrex Inc.
6. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
7. Jensen Industries; Div. of Broan-Nutone, LLC.
8. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. Maxam Metal Products Limited.
12. Metropolitan Door Industries Corp.
13. MIFAB, Inc.
14. Milcor Inc.
15. Nystrom, Inc.
16. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Door Size: As required to access mechanical items concealed behind door.

3. [Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, Factory Finish.]
4. [Stainless-Steel Sheet for Door: Nominal 0.062 inch, Finish No. 4.]
5. Frame Material: Same material, thickness, and finish as door.
6. Manufacturer standard hinge.
7. Lockable hardware.

2.03 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

2.04 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.05 PIPE ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening

C. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
3. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
6. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
7. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.

D. Escutcheons for Existing Piping:

1. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
2. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
5. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
6. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

PART 3 EXECUTION

3.01 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. The drawings do not necessarily indicate all the conditions, details, or work required. The Mechanical Contractor shall examine the building to determine the actual conditions and extent of the work. Any details not clear to this Contractor shall be referred to the Architect/Engineer for clarification prior to bidding.

C. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed or made obsolete by new work. Fire-suppression systems, equipment, and components within or routing through areas indicated for

demolition but not serving areas indicated for demolition shall not be disturbed and shall remain in service. Questions regarding applicability of or extent of demolition shall be brought to the attention of the engineer during bidding. Questions or uncertainty arising during construction shall be brought to the attention of the engineer and owner prior to demolition.

1. Piping indicated to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping indicated to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment indicated to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment indicated to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment indicated to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

D. Disposition of Removed Materials:

1. Do not reuse removed materials unless explicitly permitted by Documents.
2. Use of Owner's dumpsters for the disposition of any type of construction debris is not allowed.

E. Equipment indicated to remain Owner's property:

1. Place in storage location designated by Owner.

F. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Where demolition work is to be performed adjacent to existing work that remains in an occupied area:

1. Construct temporary dust partition to minimize the amount of contamination of the occupied space.
2. Provide temporary connections necessary to permit the Owner to occupy areas of the building to remain in use during construction.

H. Where pipe is removed and not reconnected to new work, cap end of existing services as if they were new work

3.02 MATERIAL AND WORKMANSHIP

A. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt and the weather.

B. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current standards.

C. The Engineer reserves the right to reject material or workmanship not in accordance with the Contract Documents, before or after installation.

3.03 EQUIPMENT

A. Install material and equipment in accordance with the manufacturer's written instructions.

3.04 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

P. All piping shall be run in the most direct and straight manner possible maintaining proper grading.

Q. It is the intent of these plans and specifications that most piping be concealed. Where exposed, run as close to ceiling and/or wall as possible parallel with adjacent structural or architectural elements.

R. Do not install piping in any switchgear, transformer, elevator equipment, telephone, or electrical equipment room, unless it is a branch serving that room.

S. Do not install piping above switchboards, panelboards, control panels, motor control centers, etc.

T. Arrange work to facilitate maintenance, repair or replacement of equipment. Provide access for devices that require maintenance. For concealed devices, verify that access panels are properly located and labeled.

3.05 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to requirements of Division 21 Sections specifying piping systems.

3.06 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

B. Drain Lines from Equipment:

1. Unless otherwise noted, each item of equipment requiring a drain line or a conductor for liquid shall be provided an "open site" drain, such as a standpipe, floor drain, or a janitors sink. Direct connection to existing or new waste and vent stacks or rainwater leaders is not acceptable.
2. Fire-Suppression Contractor shall also provide drains on other items of equipment as noted in Miscellaneous Work.

3. Piping shall be black steel or material of special systems, neatly installed, and secured to wall or column.

3.07 PAINTING AND TOUCH UP

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Refinish and touch up paint:

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
5. Paint exposed piping to match painted surfaces.

3.08 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.09 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.11 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.12 EXCAVATION AND BACKFILL

A. Where excavation and trenching disturb existing conditions, the contractor shall be responsible to restore the surroundings to their original condition or better, so that the appearance, landscaping, quality and condition of surfaces or finishes match adjacent areas.

B. Comply with requirements of other Divisions, including Division 31 and 32 sections.

C. Establish requirements for trench shoring and bracing to comply with codes, authorities and safety. Maintain shoring and bracing in excavations regardless of time period the excavations will be open. Remove shoring and bracing when no longer required.

D. Excavate by hand at areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.

E. Trenches: Excavate trenches for fire suppression installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working space and a minimum of 6 to 9 inches clearance on both sides of pipe.
2. Excavate trenches to depth indicated or required.
3. Limit the length of open trenches to which conduit installations can be made and the trench backfilled within the same day.
4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of sand prior to installation of pipe. Provide a minimum of 6 inches of sand cushion between rock bearing surface and pipe installations.

F. Backfill: Place soil materials in layers to required subgrade elevations for each area classification listed below.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory material.
2. Under building slabs, use drainage fill materials.
3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
4. Other areas, use excavated or borrowed materials.

G. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping by carrying material uniformly around them to approximately same elevation in each lift.
3. Areas under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
4. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

5. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
6. Subsidence: Where subsidence occurs at piping installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, replace surface treatment, and restore to its original condition.
7. Conditions Affecting Excavations:

    a. Existing conduits, pipes, utility lines, tanks, equipment, or other obstructions which are to remain, whether underground, concealed, or exposed may not be indicated on drawings. Locate such obstructions prior to start of work so as to route and install all new work to avoid these obstructions.
    b. Maintain and protect existing building utilities and services. Repair or replace these utilities and services at no cost to Owner where damage has been done during course of construction.
    c. Protect structures, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

8. Site Information: Subsurface conditions may have been investigated by other Divisions during the design of the Project. If available, reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

3.13 PROTECTION AND CLEANING

A. Protection

1. Protect openings and equipment from obstruction, breakage, misuse, damage or blemishes. Protect materials and equipment immediately upon receipt at the job site or immediately after they have been removed from their shipping containers. Unless noted otherwise, keep them clean and undamaged until final acceptance of the entire Project by the Owner. When a portion of the building is occupied by the Owner before substantial completion of the entire Project, make arrangements to transfer responsibility for protection and housekeeping for the occupied portion.
2. Protect pipe, duct and equipment openings with temporary plugs or caps. Keep openings covered until permanent connections are complete.
3. Contractor is responsible for any damage to mechanical equipment, materials or work until final acceptance of the entire project by the Owner.

B. Progress Cleaning:

1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

a. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
b. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
c. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

1) Use containers intended for holding waste materials of type to be stored.

d. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

2. Site: Maintain Project site free of waste materials and debris.
3. 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.

4. 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.
5. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
6. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
7. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Sections.
8. 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.
9. 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.
10. 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.

C. Final Cleaning:

1. Thoroughly clean fire suppression materials, equipment and apparatus to be free of dust, dirt, rust, and foreign materials before acceptance at Substantial Completion.
2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.14 TRAINING

A. General: Instruct Owner's personnel in proper operation and maintenance of mechanical systems.

1. Comply with Division 01 Section "Demonstration and Training."

B. Classroom Sessions: Used to introduce Owner's operation, maintenance, and management personnel to manuals, drawings, and other documents and aids available to operate and maintain mechanical equipment and systems.

C. Factory Specialists: Used in area of major equipment and systems to present sessions on their specific equipment and systems.

D. Hands-On Training: Conducted concurrent with functional performance testing and commissioning.

E. Video Record: Record training sessions and submit a digital copy for Owner's use.

F. Provide video documentation of the above ceiling location of all controlled devices prior to ceiling installation.

G. Training Hours: Provide training as required to familiarize owner with component location and function. A minimum of 4 hours shall be provided.

H. Include documentation of instructions in the Operation and Maintenance Manuals.

I. Obtain a written statement from the Owner that his designated personnel have been instructed.

3.15 BUILDING COMMISSIONING

A. Coordinate required commissioning work of this section with Owner’s Commissioning Agent and other commissioning-related sections for commissioning requirements and roles required in this project.

B. Provide assistance as required to support commissioning activities.

3.16 INTERRUPTION OF EXISTING FIRE SUPPRESSION SERVICE

A. The existing building will be in use during construction. Schedule and carry out the Work in such a manner as to cause the Owner a minimum of inconvenience due to service interruption. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled in advance with the Owner's site representative. All interruptions shall be conducted and shall be limited to after hours [(9:00 pm – 6:00am)] and [weekends], or as directed by the Owner. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning fire suppression system to the same operating condition which existed prior to the interruption.

B. Notify the Owner a minimum of [14] [7] [other] days prior to service interruption.

3.17 START-UP

A. Before start-up, lubricate, charge, and fill systems as specified and according to Manufacturer's instructions.

B. Test fire protection systems as specified in Sections governing their installation.

C. Perform testing, adjusting and balancing in accordance with that Section.

D. Operate equipment and systems in all their operating modes, to verify proper operation, prior to final field observation and Owner instructions. Notify the Engineer, in writing, that all systems have been tested and are functioning and operating properly.

3.18 FINAL FIELD OBSERVATION

A. A final field observation of the mechanical systems will be required before Contract Closeout. Request a final observation by the Engineer after all systems are fully completed and operational. The Engineer will schedule a field observation and generate a list of items to be corrected or completed before Contract Closeout.

3.19 DATE OF PROJECT COMPLETION

A. The date for the final performance and acceptance testing shall comply with the Schedule and shall be sufficiently in advance of the Date(s) of Project Completion to permit the execution of the testing by the Subcontractor prior to occupancy and the closeout of the Construction Contract. Any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper and satisfactory functioning of all equipment and systems, shall be completed prior to the closeout of the Construction Contract. Retests shall not relieve the Subcontractor of completion date responsibility.

B. The Contractor shall provide in the Schedule dates when each system is to be completed and outlining when tests will be performed.

END OF SECTION

SECTION 210517
SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

1.02 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 099113 - Exterior Painting: Preparation and painting of exterior piping systems.

D. Section 099123 - Interior Painting: Preparation and painting of interior piping systems.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 210500 - Common Work Results for Fire Suppression for additional submittal requirements.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Pipe Sleeves:

1. Vertical Pipe Sleeve Length: Flush with floor except in mechanical equipment areas or other wet areas for which sleeve to extend 2 inches above the finished floor. Length flush with bottom of floor if floor when viewed from below is exposed.
2. Horizontal Pipe Sleeve Length: Flush with penetrated wall.
3. Provide sealant for watertight joint.
4. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
5. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior concrete poured or concrete block walls and partitions.

1. Material:

a. Welded galvanized steel sheet metal.
b. Zinc coated galvanized steel schedule 40 pipe with plan ends.

C. Penetrations in concrete beams are prohibited without prior approval from the structural engineer.

D. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter of pipe and insulation.

3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Division 7 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. All installation shall be in accordance with the manufacturer’s written installation instructions.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts/ Sleeves:

1. Sleeves are not required for core-drilled holes except where located in equipment or mechanical rooms to minimize unexpected water or other fluids migrating to a lower level.
2. Cut inserts/ sleeves to length for mounting flush with both surfaces.
3. Provide inserts for placement in concrete formwork.
4. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
5. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
6. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
7. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

F. Structural Considerations: Do not penetrate building structural members unless indicated.

G. Provide sleeves when penetrating exterior walls, interior concrete walls, interior concrete partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Seal outside of sleeves watertight with grout.
2. Aboveground Piping:

    a. Seal outside of sleeves watertight with grout at all exterior penetrations.
    b. Pack solid using mineral fiber complying with ASTM C592.
    c. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Penetrations: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

H. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

I. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 INSTALLATION SCHEDULE

A. Pipe Passing Through Interior Concrete Walls and Interior Partitions:

1. Piping 6 inches and larger: Welded galvanized sheet metal sleeve.
2. Piping smaller than 6 inches: Zinc coated galvanized pipe sleeve.

B. Pipe Passing Through Above Grade Floors:

1. Galvanized carbon steel sleeve with welded water stop.

C. Pipe Passing Through Above Grade Exterior Walls:

1. Galvanized carbon steel sleeve with welded water stop and pipe sleeve seal system between sleeve and pipe.

D. Pipe Passing Through Below Grade Exterior Walls and Concrete Slabs on Grade:

1. Cast iron sleeve with welded water stop and pipe sleeve seal system between sleeve and pipe.

3.04 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800-Closeout Submittals for closeout submittals.

B. See Section 017900-Demonstration and Training for additional requirements.

END OF SECTION

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SECTION 210529
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

I. 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.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

N. FM (AG) - FM Approval Guide; Current Edition.

O. MFMA-4 - Metal Framing Standards Publication; 2004.

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

Q. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. UL (DIR) - Online Certifications Directory; Current Edition.

S. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports with detailed engineering analysis conducted by a certified professional engineer, utilizing specified performance requirements and design criteria.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 210500 - Common Work Results for Fire Suppression for additional submittal requirements.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors.

D. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of fire suppression work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Fire Resistance: Provide hardware rated for 60 minutes resistance unless specifically indicated by the authority having jurisdiction.

F. Vibration Isolation and Seismic Restraint Requirements: See Section 210548.

G. Materials for Metal Fabricated Supports: Comply with Section 055000.

1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

2.02 BEAM CLAMPS

A. Manufacturers:

1. B-Line, a brand of Eaton Corporation.
2. FNW; 7201.
3. Anvil International, LLC.
4. Unistrut, a brand of Atkore International, Inc.
5. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).

D. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.

E. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

F. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish.

G. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.03 PIPE HANGERS

A. Band Hangers, Adjustable:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation
b. Anvil International, LLC.
c. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. J-Hangers, Adjustable:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. FNW; 7025.
c. Unistrut, a brand of Atkore International, Inc.
d. Anvil International, LLC.
e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

C. Swivel Ring Hangers, Adjustable:

1. Manufacturers:

a. Unistrut, a brand of Atkore International, Inc.
b. B-Line, a brand of Eaton Corporation.
c. Anvil International, LLC.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 1, epoxy-plated, zinc-colored.
3. MSS SP-58 type 10, epoxy-plated copper.
4. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
5. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

D. Clevis Hangers, Adjustable:

1. Manufacturers:

a. Anvil International, LLC.
b. B-Line, a brand of Eaton Corporation.
c. FNW; 7005.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Stainless Steel Pipe: MSS SP-58 Type 1, stainless steel.
5. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch.
6. FM (AG) listed: Pipe sizes 2-1/2 to 8 inch.

E. Nonmetallic Pipe Hangers:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. DecoShield Systems, Inc; Snap-2 Hangers.
c. Anvil International, LLC.

2. CPVC fabricated, snap-action hanger for pendant or sidewall applications.

2.04 PIPE CLAMPS

A. Riser Clamps:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. FNW; 7020.
c. Anvil International, LLC.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

B. Extension Split Pipe Clamp:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. FNW; 7001.
c. Anvil International, LLC.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
3. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
4. Provide hanger rod and nuts of the same type and material for a given pipe run.
5. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

D. Strut Clamps:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. FNW; 7815.
c. Unistrut, a brand of Atkore International, Inc.
d. Anvil International, LLC.
e. Gripple Inc; GCS.
f. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
3. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.
4. Service Temperature Range: Minus 65 to 275 degrees F.

2.05 PIPE HANGER RODS

A. Steel Hanger Rods:

1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated:

Maximum Load (Lbs.) (650 degrees F Maximum Temperature)	Rod Diameter (inches)
700	3/8

1300	1/2
2100	5/8
3200	3/4
4400	7/8
5800	1
9400	1-1/4

2.06 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Stanchions:

1. Manufacturers:

a. ASC Engineered Solutions.
b. Anvil International, LLC.
c. FNW.
d. B-Line, a brand of Eaton Corporation.
e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
4. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

C. U-Bolts:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.
b. FNW; 7610.
c. Anvil International, LLC.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MSS SP-58 type 24, 304 stainless steel u-bolt for pipe support or anchoring.

D. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:

    a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
    b. Support From Below: MSS SP-58 types 35 through 38.

E. Overhead Pipe Supports:

1. Manufacturers:

    a. B-Line, a brand of Eaton Corporation.
    b. HoldRite, a brand of Reliance Worldwide Corporation.
    c. Anvil International, LLC.
    d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

F. Plenum Pipe Supports:

1. Manufacturers:

    a. B-Line, a brand of Eaton Corporation.
    b. HoldRite, a brand of Reliance Worldwide Corporation.
    c. Anvil International, LLC.
    d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

G. Telescoping Pipe Supports:

1. Manufacturers:

    a. B-Line, a brand of Eaton Corporation.
    b. HoldRite, a brand of Reliance Worldwide Corporation.
    c. Anvil International, LLC.
    d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2.07 ANCHORS AND FASTENERS

A. Manufacturers - Mechanical Anchors:

1. FNW; 7502.
2. Hilti, Inc.
3. ITW Red Head, a division of Illinois Tool Works, Inc.
4. Powers Fasteners, Inc.
5. Simpson Strong-Tie Company Inc.

B. Manufacturers - Powder-Actuated Fastening Systems:

1. Hilti, Inc.
2. ITW Ramset, a division of Illinois Tool Works, Inc.
3. Powers Fasteners, Inc.
4. Simpson Strong-Tie Company Inc.

C. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

D. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

E. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

F. Hollow Masonry: Use toggle bolts.

G. Hollow Stud Walls: Use toggle bolts.

H. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

I. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.

J. Sheet Metal: Use sheet metal screws.

K. Plastic and lead anchors are not permitted.

L. Powder-actuated fasteners are not permitted.

M. Hammer-driven anchors and fasteners are not permitted.

N. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

O. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

1. Comply with MFMA-4.
2. Channel Material: Use galvanized steel.
3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
4. Manufacturer: Same as manufacturer of metal strut channel framing system.

P. Concrete Inserts:

1. Manufacturers:

a. B-Line, a brand of Eaton Corporation.

b. HoldRite, a brand of Reliance Worldwide Corporation.
c. Anvil International, LLC.
d. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's written instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Install metal pipe hangers and metal trapeze pipe hangers in compliance with latest version of MSS SP-58.

1. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2 and larger. Install additional attachments at changes in direction of piping.

D. Install building attachments within concrete slabs or attach to structural steel. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.

F. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.

G. Install lateral bracing with supports and pipe hangers to prevent swaying.

H. Where possible, support all piping and equipment from structural members, beams, and joists.

I. Provide structural steel angles, channels, or other members to support piping and equipment where structural members do not occur as required for proper support.

J. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.

K. Install supports and hangers to permit freedom of movement between pipe anchors, to allow controlled thermal movement of piping systems, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar devices.

L. Install hangers and supports to provide indicated pipe slopes and not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

N. Do not provide support from suspended ceiling support system or ceiling grid.

O. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

P. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

Q. Field-Welding (where approved by Architect): Comply with Section 055000.

R. Concrete Inserts and Continuous Insert Channels

1. Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

S. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

T. Secure fasteners according to manufacturer's recommended torque settings.

U. Contractor must coordinate pipe weights with the structural design consultant for all pipe sizes prior to supporting from wood structures.

V. Remove temporary supports.

W. Provide electrolytic corrosion (Electrolysis) protection between dissimilar metals. Use of tape is prohibited.

X. Trim excess length of continuous-thread hanger and support rods to 1 inch. Provide protection from personal injury via red vinyl round end caps if end of hanger or support rod is between 48 inches and 84 inches above finished floor.

Y. Provide roof mounted supports for all roof mounted pipe. Secure bottom of support flat on roof deck. Account for roof slope to provide level mounting service for equipment. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counterflashing by the General Contractor.

Z. Provide anchors where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

AA. Painting

1. Touchup: Clean abraded areas and field welds of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1.

    a. Paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Galvanized Surfaces: Clean bolted connections, welds, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

BB. Hanger and Support Spacing

1. Provide a hanger within 24 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
2. Where several pipes can be installed at the same elevation in parallel, provide multiple or trapeze hangers.
3. Support riser piping independently of connected horizontal piping.
4. Space hangers for pipe as follows unless stated differently within each pipe system specification section:

Pipe Material	Pipe Size	Max Spacing Horizontal	Max Spacing Vertical
Carbon and Stainless Steel	1/2" through 1-1/4"	6'-0"	15’-0”
Carbon and Stainless Steel	1-1/2" through 2"	8'-0"	15’-0”
Carbon and Stainless Steel	2-1/2" through 4"	10'-0"	15’-0”
Carbon and Stainless Steel	5" through 8"	12'-0"	15’-0”
Carbon and Stainless Steel	10" through 12"	12'-0"	15’-0”

Pipe Material	Pipe Size	Max Spacing Horizontal	Max Spacing Vertical
Carbon and Stainless Steel	14" and over	12'-0"	15’-0”

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment nameplates.

B. Valve tags.

C. Pipe markers.

D. Ceiling labels.

E. Control device signs.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. See Section 210500 - Common Work Results for Fire Suppression for additional submittal requirements.

C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

E. Product Data: Provide manufacturers catalog literature for each product required.

F. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

G. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Tags.

F. Pumps: Nameplates.

G. Valves: Tags and ceiling tacks where above lay-in ceilings.

H. All Other Division 21 Equipment not listed above: Nameplates and ceiling labels where located above ceilings.

2.02 EQUIPMENT NAMEPLATES

A. Letter Color: Black.

1. Letter Height: 1 inch.
2. Background Color: White.
3. Thickness: 1/8 thick, predrilled holes.
4. Label Content: Equipment drawing designation or unique number.
5. Fastener: Stainless steel screws or rivets.

B. Material: Plastic, comply with ASTM D709.

C. Adhesive: Permanent type compatible with label and substrate.

2.03 VALVE TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Fastener: Brass wire-link chain.

C. Valve Tag Chart: Printed letter size list in anodized aluminum frame. Chart to include at a minimum the following: pipe system, valve location, manual or automatic.

2.04 PIPE MARKERS

A. Plastic Pipe Markers: Factory fabricated, color-coded, with lettering indicating service, and showing flow direction, letter size at least 1-1/2” high.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Label Content: Identify piping service using the same designation as on the documents with arrow showing flow direction.

2.05 CEILING LABELS

A. Description: Clear background label with black lettering, 1/2 inch in height. Clear acrylic adhesive backing. Adhesive shall be compatible with label and with substrate.

2.06 CONTROL DEVICE SIGNS

A. Provide weatherproof chain fastened signs for control devices according to requirements of NFPA 13 and NFPA 14.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping.

C. Install control device signs at control devices per requirements of NFPA 13 and NFPA 14.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling labels to identify devices (valves and other equipment) installed above ceilings. Locate closest to device and where applicable, locate on grid not ceiling panel. Refer to Owner’s requirements for naming convention that may be differ from the described herein.

1. When an access panel is located in a ceiling, locate ceiling label directly on the access panel.

G. Install labels on all Division 21 equipment. Labels to be easily accessible and visible.

3.03 SCHEDULES

A. Pipe Label and Color Schedule.

1. Fire Suppression Piping:

a. Background Color: Red.
b. Letter Color: White.

END OF SECTION

SECTION 211300
FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preaction sprinkler system.

B. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.

D. Section 210553 - Identification for Fire Suppression Piping and Equipment.

E. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

F. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.

F. AWWA C606 - Grooved and Shouldered Joints; 2022.

G. FM (AG) - FM Approval Guide; Current Edition.

H. FM 1110 - Approval Standard for Indicator Posts; 1990.

I. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2022, with Errata.

K. UL (DIR) - Online Certifications Directory; Current Edition.

L. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 210500 - Common Work Results for Fire Suppression for additional submittal requirements.

C. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1. Provide product data for all material and equipment proposed for the system.
2. Where multiple items are shown on a data sheet, clearly identify which types, sizes, or models are proposed.

D. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
3. Submit shop drawings, product data, and hydraulic calculations to Authorities Having Jurisdiction and Owner’s Insurance Company for approval. Submit proof of approval to Architect.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard. Store extra sprinklers in contractor provided wall-mounted, steel cabinet with hinged cover.

H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Comply with FM (AG) requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Fire Protection Engineer or NICET Level 4 designer experienced in design of this type of work and licensed in the State in which the Project is located using performance requirements and design criteria indicated herein.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.

F. Welder Qualifications: Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

G. Equipment and Components: Provide products that bear FM (AG) label or marking and be approved by FM for the purpose for which it will be used.

1. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

H. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

I. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

J. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

K. Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

L. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 FIRE SUPPRESSION PIPING

A. Steel Pipe:

1. Black steel pipe welded and seamless, Type E, Grade B, ASTM A53; black welded and seamless steel pipe for fire protection use in non corrosive areas, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
2. Galvanized steel pipe welded and seamless, Type E, Grade B, ASTM A53; black welded and seamless steel pipe for fire protection use in corrosive areas, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.

3. Fittings:

a. Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4.
b. Malleable and ductile iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3.
c. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9.
d. Galvanized Steel Couplings: ASTM A 865, threaded.
e. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel. For wet pipe systems mechanical tee fittings with full iron back equal to Grinnell Figure 730 will be allowed only as needed for connection to existing systems.
f. Outlets for drypipe and preaction systems shall be mechanical tees.
g. Mechanical tees with U-bolt back or other fastening means are not allowed.

4. Welding Materials:

a. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

5. Finish:

a. Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in drypipe and pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or grooved hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Department connection only may be black steel piping and fittings.

2.02 UNIONS AND FLANGES

A. 2 inches and Smaller Steel:

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Grooved couplings may be used in lieu of unions.

B. 2-1/2 inches and Larger Steel:

1. ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

2.03 MECHANICAL GROOVED PIPE CONNECTIONS

A. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, SPF/Anvil, or Tyco/JCI may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters shall be from the same manufacturer.

C. Grooved fittings to be UL, FM and designed to accept grooved end couplings and shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

D. Grooved joint couplings to be UL, FM and shall consist of two ductile iron housing segments conforming to ASTM A536, Grade 65-45-12.

E. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design or an approved gasket consisting of a pressure responsive center-leg. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

F. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

2.04 FLEXIBLE SPRINKLER DROP FITTINGS

A. Manufacturers:

1. Flex Head Industries.
2. Victaulic.
3. Viking.

B. Corrugated Type 304 stainless steel hose with braided Type 304 stainless steel exterior cover, welded stainless steel or zinc plated steel inlet and outlet threaded fittings with EPDM seals. 175 PSI pressure rating. 225 degree F temperature rating, 1 inch minimum internal hose diameter. 48” maximum hose length, straight or angle outlet configuration. Galvanized steel ceiling support bar and brackets selected to match project ceiling support system requirements. UL Listed UL Listed per UL-2443 to 175 PSI with a 2 inch minimum bend radius and FM approved per FM-1637 to 200 PSI with a 7 inch minimum bend radius.

2.05 SPRINKLERS

A. Manufacturer:

1. Tyco Fire & Building Products LP.
2. Reliable Automatic Sprinkler Co., Inc.
3. Victaulic Company.
4. Viking Corporation.

B. Quick response standard coverage sprinkler heads are to be the basis for design unless noted otherwise on the drawings or within these specifications.

C. Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" or 17/32” discharge orifice except where greater than normal density requires large orifice.

D. Sprinklers shall be UL listed and or FM approved, rated to a minimum of 175 PSI working pressure. Shall be die-cast brass frame to ATSM 65-30 and can be connected to the piping system with NPT, BSPT or IGS™ grooved connections.

E. Head guards shall be UL listed [and FM approved] for use with the sprinkler in which its attached.

2.06 VALVE SUPERVISION (TAMPER SWITCHES)

A. Supervisory/ Tamper Switches: UL listed and FM approved, to monitor position of valve, tamper resistant cover screws, single pole double throw switch contacts, suitable for 24 VDC, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

B. Supply supervisory device specifically designed to mount on, and operate reliably with the type of control valve being monitored.

2.07 FLOW SWITCHES

A. Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system, suitable for 24 VDC.

2.08 PRESSURE SWITCHES

A. Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

2.09 LOCAL ALARM

A. Weatherproof exterior-mounted electric horn/strobe with red painted metal housing, mounting base and weatherproof gasket seal, and electrical characteristics compatible with alarm system. The horn strobe should be mounted above or as close as possible to the fire department connection.

2.10 VALVES

A. Manufacturers:

1. Anvil International, Inc.
2. Conbraco Industries, Inc.; Apollo Valves.
3. Milwaukee Valve Company.
4. NIBCO INC.
5. Tyco Fire & Building Products LP.
6. Victaulic Company.
7. Watts Water Technologies, Inc.

B. General Requirements

1. Source Limitations: Furnish valves of same kind by same manufacturer.
2. Valve-End Connections:

    a. Flanges on Iron Valves: ASME B16.1 or ASME B16.42.
    b. Threaded Ends: ASME B1.20.1.
    c. Grooved Ends: AWWA C606.

3. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
4. Valve Sizes: Same as upstream piping unless otherwise indicated.
5. Valve Actuator Types:

    a. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.

b. Handwheel: For other than quarter-turn trim and drain valves.
c. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

C. Ball Valves:

1. 2 inches and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL 1091 listed and FM 1112 listed. Watts No. B-6000 UL.

D. Gate Valves:

1. 2 inches and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads, UL 262 and FM 1120/1130 listed.
2. 2-1/2 inches and larger: Outside screw and yoke gate valves, 175 psig, cast or ductile iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads, UL 262 and FM 1120/1130 listed.

E. Butterfly Valves:

1. 2 inches and smaller: Bronze body butterfly valve, 300 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem, UL 1091 listed and FM 1112 listed.
2. 2-1/2 inches and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 300 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc, UL 1091 listed and FM 1112 listed. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.

F. Check Valves:

1. 2 inches and smaller: Bronze body, threaded end, Y-pattern, regrind-able bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward, UL 312 listed and FM 1210 listed.
2. 3 inches and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward, UL 312 listed and FM 1210 listed.
3. Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

G. Spring Loaded Check Valves:

1. 2 inches and smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.

2. 2-1/2 inches and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 175 psig.

H. Drain Valves:

1. 3/4 inch minimum, two piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap, UL 258 or FM 1140 listed.

I. Fire Suppression Double Check Valve Assembly, Backfow Device:

1. Manufacturers:

a. Ames.
b. Conbraco Industries, Inc.; Apollo Valves.
c. FEBCO.
d. Flomatic Corporation.
e. Watts.
f. Zurn Industries, LLC.

2. ASSE 1015 double check backflow preventer with 2 independent spring loaded swing type check valves, 2 isolation butterfly or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Size for maximum pressure drop of 5 psi through middle third of flow range. Constructed of bronze or epoxy coated cast/ductile iron or stainless steel body with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

2.11 SPECIALTY VALVES

A. Manufacturer:

1. Tyco Fire & Building Products LP.
2. Reliable Automatic Sprinkler Co., Inc.
3. Victaulic Company.
4. Viking Corporation.

B. Air Pressure Maintenance Device:

1. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

C. Preaction Valves:

1. Preaction Valve shall be [UL, FM] with a low air “single-set-point” latched clapper design with no “air-to-water” differential requirement with a

minimum required air pressure of 13 PSI; working pressure to 300 PSI; black enamel coated ductile iron body conforming to ASTM A-536, grade 65-45-12; valve shall be externally resettable; internal parts shall be replaceable without removing the valve from the installed position; valve shall not require a separate check valve downstream. Basis of Design: Victaulic Firelock NXT Series 769N

D. Pressure Reducing Valves
   1. Pressure Reducing Non-return Valve shall be UL Listed and FM Approved, 365 PSI rated body with pilot reducing range of 60 PSI – 175 PSI [UL] and 30 PSI – 235 PSI [FM], and water operating temperatures to 122°F. Consisting of a grooved, flanged, or threaded end ductile iron body conforming to ASTM A536 with electrostatic powder coated polyester red coating carbon steel body to ASTM A216. Valve internal components shall be reinforced polyisoprene [NBR] [EPDM] elastomer seals. The valve shall have a straight-through Y-type-body with unobstructed flow path. Valve actuation shall be accomplished by a fully peripherally supported, one-piece balanced rolling-diaphragm. The diaphragm assembly shall be the only moving part. Control trim system shall be 316 stainless steel. The control system shall consist of a 2-Way adjustable, pressure reducing pilot valve. Basis of Design: Victaulic Series 867-42T-20.
   2. Pressure Reducing Valve (PRV) Flow Test Valve: Where a testing valve is required downstream of a pressure reducing valve to test the flow through the PRV; per the requirements of NFPA, a specifically manufactured valve for this purpose shall be used. Flow test valve shall have a grooved inlet and 2-1/2” hose thread outlet equipped with cap and chain and lockable handle. A single body flow test valve shall be of brass body construction, contain a Teflon seat, and be factory tested to 300 psi. Basis of Design: Victaulic Series FTV.

2.12 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.13 PIPING SPECIALTIES

A. Pressure Gauges

   1. Manufacturers:

      a. AMETEK; U.S. Gauge Division.
      b. Ashcroft, Inc.
      c. H. O. Trerice.
      d. Weiss Instruments.
      e. Weksler Instruments.
      f. WIKA Instrument Corporation.

2. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

    a. Case: Cast aluminum, stainless steel or brass with brass bourdon tube.
    b. Diameter: Minimum of 3-1/2 inch.
    c. Mid-Scale Accuracy: 99 percent.
    d. Scale: Display in psi and kPa.
    e. Pressure Gauge Range: [0 to 250 psig minimum] [0 to 300 psig].

B. Strainers:

1. "Y" type strainers with cast iron body and 30-mesh stainless steel screen.

C. Preaction Valve:

1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.

D. Air Venting Valves:

1. Manufacturers:

    a. AGF Manufacturing; PURGEnVENT 7700.
    b. Potter Electric Signal Company, LLC; PAV or PAAR-B.

2. Single automatic air vent with a connection conforming to NFPA 13-2016 Chapter 8.16.6 shall be provided on each wet and compressed air dry pipe system utilizing metallic pipe.
3. Air vent shall be UL Listed and FM Approved.

E. Test Connections:

1. Inspector's Test Connection for Preaction Systems:

    a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
    b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
    c. Supply discharge orifice with same size as corresponding sprinkler orifice.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's written instructions.

C. Sprinklers shall be installed per manufacturer’s installation instructions and with sprinkler wrench manufactured specifically for automatic sprinkler being installed.

D. Drawing schematics, plans, and diagrams indicate approximate location and arrangement of piping systems. Follow the indicated piping arrangement during installation unless deviations are approved through the shop drawing process. Provide sprinklers, fittings, drain valves, piping, equipment, and accessories as required to accommodate field conditions. Indicate structural details that affect sprinkler system design on Drawings.

E. Coordinate sprinkler piping, sprinklers and associated equipment with existing ceiling or roof materials, lighting, ductwork, conduit, piping, suspended equipment, structural and other building components.

F. Perform all final connections between new work and existing systems with only one outage per system.

G. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

H. Provide access to valves and specialties for maintenance.

I. Provide automatic air venting valves are required in NFPA.

J. Install alarm devices in piping systems and locate alarm gong on exterior building wall per requirements of NFPA.

K. Install pressure gages on each riser, each sprinkler test connection, at top of each standpipe, and at inlet and outlet of each fire pump and jockey fire pump.

L. Locate flow and pressure switches where indicated and where required to obtain specified zoning to isolate floors and major areas of floors. Provide valved test connection for flow switch adjacent to flow switch. Pipe to floor drain. Test flow switch to verify proper operation.

M. Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide a riser

shutoff valve and a capped hose thread drain valve at the bottom of each riser. Provide capped hose thread drain valves to allow draining of each portion of piping.

N. Install specialty valves in vertical position fire protection riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and preaction controls.

O. Place pipe runs to minimize obstruction to other work.

P. Place piping in concealed spaces above finished ceilings.

Q. Install piping above ceilings in areas with suspended ceilings. Install piping in exposed areas as high as possible. Install sprinkler piping a minimum of 7 feet 6 inches above finished floor.

1. When minimum elevation requirement cannot be met, obtain approval from the Engineer prior to installation and mark such piping to identify it as a clearance hazard.

R. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

S. Make joints using adapters compatible with materials of both piping systems when joining piping of dissimilar metals.

T. Do not route piping within exterior walls.

U. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, egress pathways, including the required service space for this equipment, unless the piping is serving this equipment.

V. Provide approved or listed Inspector’s test connection valve assembly at riser, or at the most remote location per NFPA 13.

1. Inspectors test piped to the exterior of the building shall be located a maximum of 2 feet above grade and discharge onto a splash block.

W. Provide concrete splash blocks or other approved methods at system exterior drains that do not discharge to a hard-covered surface to protect landscape from erosion due to water discharge from the drains.

X. Center sprinklers in two directions in ceiling tile and provide piping offsets as required. Do not install wet type sprinklers in areas subject to freezing.

Y. Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler

heads level in locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, and as required by NFPA.

Z. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

AA. Conform to NFPA 13 requirements for “Temperature Ratings of Sprinklers Based on Distance from Heat Sources.”

BB. To minimize the potential of freezing, extend dry pendent sprinklers a minimum of 6 inches into heated area before connection to wet sprinkler piping.

CC. Install flexible sprinkler drop fittings in accordance with manufacturer’s installation instructions following minimum bend radii, maximum number of bends and bend distance from end requirements.

DD. Adjust water flow switches to transmit an alarm within 90 seconds of opening the inspector’s test valve.

EE. Provide a minimum of one water flow switch and one supervisory/ tamper switch for each sprinkler zone.

FF. Adjust valve position switches to transmit a supervisory signal within two revolutions of valve operating hand wheel or crank (away from its full open position).

GG. Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade.

HH. Install automatic ball drip valves at low points to drain piping between the fire-department connection and check valve. Route drain piping to a floor drain or outside the building.

II. Install control valves, test assemblies, and drain risers at standpipes when connecting sprinkler piping.

JJ. Where static pressure exceeds 100 psi at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi.

KK. Pipe Hangers and Supports:

1. Provide pipe hangers and supports in accordance with Section 220529, NFPA, ASME B31.9, applicable fire code, or MSS SP-58 unless indicated otherwise.
2. Support horizontal piping as indicated.

3. Install hangers to provide minimum one inch space between finished covering and adjacent work.
4. Support horizontal piping within 24 inches of each fitting and coupling.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 210548.
10. U Bolt Strap-Tee pipe fittings are not permitted.

LL. Protect sprinklers subject to mechanical injury with guards as follows:

1. Provide guards in mechanical equipment rooms, electrical equipment rooms, janitor's closets, and storage areas where distance from sprinkler deflector to finish floor is less than 10 feet.
2. In all other areas, provide guards where distance from sprinkler deflector to finish floor is less than 7 feet.
3. Provide sprinkler guards for pendent or upright sprinkler installation below obstructions.

MM. Painting: Paint unfinished sprinkler riser piping, unfinished fire department connection (FDC) piping, exposed sprinkler piping in stairwells, and sprinkler piping in all mechanical, electrical and telecommunications equipment rooms with two (2) coats of Fire Protection RED. Do not paint sprinklers, escutcheons or cover plates. Replace any sprinklers that are inadvertently painted. Comply with Section 099100.

3.02 SIGNAGE

A. Install as required by NFPA 13, NFPA 14, and NFPA 25, including information signs noting the locations of auxiliary drains; general information signs detailing the occupancy, building type, and other information; control valve signs indicating what portion of the system is isolated by the valve; etc.

3.03 PIPE CONNECTIONS

A. General

1. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.
2. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

B. Threaded Pipe Joints.

1. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

C. Mechanical Grooved Pipe Connections.

1. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.
2. Grooved Joints: Assemble joints with listed couplings and gaskets, lubricant, and bolts in accordance with manufacturer’s published installation instructions.

    a. Dry and preaction systems shall utilize gaskets listed for such applications.

3. Grooved Solution Training: Grooved coupling manufacturer representative shall:

    a. Provide on-site field training to installing contractor’s field personnel in the proper use of grooved tools, application, and installation techniques of grooved piping products and solutions.
    b. Periodically visit the job site to ensure best practices in grooved product installation are consistently being followed.
    c. Instruct the installing contractor to remove and replace any improperly installed grooved products

3.04 FIELD TESTS AND INSPECTIONS

A. Verify, inspect, and test systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

1. Area Restoration: Restore areas disturbed by the fire protection system installation to the condition existing prior to start of construction.
2. Field inspect areas of sprinkler installation for potential interference with structure, ducts, cable trays, electrical or mechanical equipment, and other similar interferences. Carefully coordinate Work under this section with other Work.
3. Below Grade: Test with water per NFPA 24 at a minimum of 200 psig, or at 50 psig in excess of the system working pressure, whichever is greater for 2 hours. Piping shall maintain test pressure +/- 5 psi for the duration of the test and there shall be no visible signs of leakage.
4. Above Grade: Test with water per NFPA 13 at a minimum of 200 psig, or 50 psig in excess of the system working pressure, whichever is greater, for 2 hours and shall maintain that pressure without loss.
5. For modifications to existing piping bring system up to operating pressure gradually. Visually examine the piping for leaks at one-half the system operating

pressure. Perform a final examination at the system operating pressure. No leaking from the piping indicates that the system meets the requirement of the project.

B. All pressure tests are to be documented on NFPA Contractor's Material and Test Certificate forms.

3.05 CLEANING

A. Flush sprinkler systems to remove particulate or pipe assembly material that may interfere with the functionality of the sprinkler heads. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

B. Clean dirt and debris from sprinklers.

C. Remove and replace sprinklers with paint other than factory finish.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.07 SPECIAL SPRINKLER APPLICATIONS

A. Mission Critical Facilities: To prevent water from entering sprinkler offsets and return bends located over mission critical equipment, a flexible dry sprinkler shall be considered to ensure water only enters the piping and not the flexible sprinkler drop until sprinkler operation during a fire event. Assembly shall be UL listed [FM approved]. Basis of Design: VicFlex Series VS1 Flexible Dry Sprinkler.

3.08 SCHEDULES

A. Steel Pipe Wall Thickness Schedule:

1. Piping 2 inches and under shall be minimum schedule 40.
2. Piping with threaded connections greater than 2 inches shall have a minimum wall thickness of schedule 40.
3. Piping with mechanical grooved connections greater than 2 inches shall have a minimum wall thickness of schedule 10.

B. Sprinkler Schedule:

1. Sprinklers shall be listed by a nationally recognized testing laboratory and be selected per their Listing and/or Approval, manufacturer’s instructions, and applicable NFPA requirements. Provide as follows unless stated differently herein or on the drawings.

a. Pendent Sprinklers: Chrome plated, unless other finish is requested. Use below suspended ceilings. Provide semi-recessed escutcheons matching sprinkler finish.

C. Sprinkler Temperature Rating Schedule:

1. Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (155 degree F) fusible link or glass bulb type unless stated otherwise below or per requirements of NFPA.

D. Spare Sprinkler Heads:

1. Provide quantity of spare heads as noted below and 1 wrench for each type of head and each temperature range installed.

a. Provide 6 spare heads per 300 or less installed heads.
b. Provide 12 spare heads per 1000 or less installed heads.
c. Provide 24 spare heads for more than 1000 installed heads.
d. Provide steel cabinet for storage of heads and wrenches. Provide an equal number of concealed cover plates and/or sprinkler escutcheons for each spare sprinkler head.

END OF SECTION

SECTION 212200
CLEAN-AGENT FIRE-EXTINGUISHING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This specification outlines the requirements for a "Total Flood" Clean Agent Fire Extinguishing System with automatic detection and control. The work described in this specification includes performance criteria allowing a third party Professional Fire Protection Engineer or NICET Level 4 designer to provide all engineering, labor, materials, equipment, and service necessary and required, to install, complete, and test the clean agent fire extinguishing system.

B. The existing FM 200 system shall be modified as required based on all ceiling and plenum modifications. The NOC HVAC system currently includes a fully ducted return air system. The new NOC HVAC system will utilize the NOC ceiling plenum as a return air plenum.

1.02 SECTION INCLUDES

A. Total flooding extinguishing system for enclosed spaces.

B. Fire suppression system control panel.

C. Space or area signage.

D. System piping and specialties.

E. Clean-agent containers.

F. Agent discharge nozzles.

1.03 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 087100 - Door Hardware: Release hardware for automatic closing doors.

D. Section 099123 - Interior Painting.

E. Section 210553 - Identification for Fire Suppression Piping and Equipment.

F. Section 211300 – Fire Suppression Sprinkler Systems.

G. Section 23 0913 - Instrumentation and Control Devices for HVAC

H. Section 233300 - Air Duct Accessories: Fire and smoke dampers.

I. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

J. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

K. Section 284600 - Fire Detection and Alarm: Building fire alarm system and devices.

1.04 REFERENCE STANDARDS

A. Americans with Disabilities Act, Title 24, Latest Edition.

B. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B31.1 - Power Piping; 2024.

E. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

F. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

I. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

J. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

M. FM (AG) - FM Approval Guide; Current Edition.

N. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--

Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).

O. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).

P. ISO 9000 - Quality Management Systems -- Fundamentals and Vocabulary; 2015.

Q. ITS (DIR) - Directory of Listed Products; Current Edition.

R. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

S. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

U. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2022, with Errata.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. Underwriters Laboratories, Inc. (UL) Publications:

1. UL 217: Standard for Single and Multiple Station Smoke Alarms
2. UL 228: Standard for Door Closers-Holders, With or Without Integral Smoke Detectors
3. UL 268: Smoke Detectors for Fire Alarm Systems
4. UL 268A: Standard for Smoke Detectors for Duct Application
5. UL 393: Indicating Pressure Gauges for Fire Protection Service: Current Edition, Including All Revisions.
6. UL 404: Gauges, Indicating Pressure, for Compressed Gas Service: Current Edition, Including All Revisions.
7. UL 521: Standard for Heat Detectors for Fire Protective Signaling Systems
8. UL 864: Standard for Control Units and Accessories for Fire Alarm Systems
9. UL 1638: Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
10. UL 1971: Standard for Signaling Devices for Hearing Impaired

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene two weeks before starting section work; require attendance by affected installers.

1.06 PERFORMANCE REQUIREMENTS

A. This installation shall be made in strict accordance with the drawings, specifications and applicable NFPA Standards. All equipment and devices used shall be listed by the standardizing agencies (UL and/or FM).

B. Design and installation of the fire detection/SAPPHIRE fire suppression system will be in strict accordance with the following guidelines and regulatory agencies:

1. NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems
2. NFPA 72 National Fire Alarm and Signaling Code, Latest Edition
3. NFPA 70 National Electrical Code, Latest Edition
4. Americans with Disabilities Act, Title 24, Latest Edition

1.07 EXCLUSIONS

A. The work listed below shall be provided by others, or under other sections of this specification:

1. 120 VAC or 220 VAC power supply to the system control panel.
2. Interlock wiring and conduit for shutdown of HVAC, dampers and/or electric power supplies, relays or shunt trip breakers.

1.08 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 210500 - Common Work Results for Fire Suppression for additional submittal requirements.

C. Product Data: Provide system and component data bearing approval stamp from Authority Having Jurisdiction and Owner's fire insurance underwriter. Include detectors, release devices, discharge nozzles, manual controls, alarm devices, switches, annunciators, extinguishing agent, extinguishing agent containers, manifolds, and control panel.

D. Shop Drawings:

1. Provide stamp of approval plans from Authority Having Jurisdiction, Fire Marshal, and Owner's fire insurance underwriter. Prepare plans in accordance with NFPA 2001.
2. Floor Plan(s): System layout with proposed raceway, piping, and component locations with a minimum drawing scale of 1/8 inch to 1 foot, use larger scale for details.
3. Schematics: System riser, control and wiring diagrams with written sequence of operation detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay, and agent discharge for each zone or system.
4. Submit approved plans to the architect/engineer for record.

E. Design Data: Submit design calculations stamp of approval from Authority Having Jurisdiction, Fire Marshal, and Owner's fire insurance underwriter. Include calculated system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes. Prepare design calculations in accordance with NFPA 2001.

1. Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices, and auxiliary components under full load conditions.

F. Certificates: Certify that products meet or exceed specified requirements.

1. Manufacturer: Certify that system meets or exceeds specified requirements.
2. Welders: Submit certificate indicating compliance with ASME BPVC-IX and AWS D1.1/D1.1M.

G. Manufacturer's Instructions: Include recommended equipment installation and system components.

H. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.

I. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.

J. Designer's qualification statement.

K. Manufacturer's qualification statement.

L. Installer's qualification statement.

M. Maintenance contract.

N. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.

O. Operation and Maintenance Data:

1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
2. Include manufacturer recommended spare parts list.
3. Include checklists and procedures for emergencies, troubleshooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

P. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

Q. Maintenance Materials: Furnish the following for Owner's use;

1. See Section 016000 - Product Requirements for additional provisions.
2. Equipment Maintenance Tools: One set, including special tools necessary for servicing and maintaining the equipment installed.
3. Extra Detectors: One of each type.

1.09 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Fire Protection Engineer or NICET Level 4 designer experienced in design of this work and licensed in the State in which the Project is located using performance requirements and design criteria indicated herein.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1. ISO 9000 registered.
2. The manufacturer brand name shall appear on all major components.
3. All devices, components, and equipment shall be the products of the same manufacturer or supplied by the same manufacturer.
4. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.
5. All devices and equipment shall be UL listed and/or FM approved.
6. Locks for all cabinets shall be keyed alike

C. Installer Qualifications:

1. The installing contractor shall be trained by the supplier to design, install, test, and maintain fire suppression systems.
2. Company specializing in performing work of the type specified and with at least five years of documented experience and approved by manufacturer.
3. The installing contractor shall be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire suppression systems, in strict accordance with all applicable codes and standards.
4. The installing contractor shall show evidence the company carries a minimum $2 million liability and completed operations insurance policy. These limits shall supersede limits required in the general conditions of the specifications.
5. The installing contractor shall maintain, or have access to, a clean agent recharging station. The installing contractor shall provide proof of his ability to recharge the largest clean agent system within 24 hours after a discharge. Include the amount of bulk agent storage available.

6. The installing contractor shall be an authorized stocking distributor of the clean agent system equipment so that immediate replacement parts are available from inventory.
7. The installing contractor shall show proof of emergency service available 24 hours a day, 7 days a week.

D. Welder Qualifications: Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.11 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide two year system warranty for complete replacement fire extinguishing agent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ANSUL, a Tyco brand, Johnson Controls International, LLC.

B. Fike Corporation.

C. Kidde Fire Systems, a Carrier Company.

D. Pyro-Chem, a Tyco brand, Johnson Controls International, LLC.

2.02 CLEAN-AGENT FIRE SUPPRESSION SYSTEM REQUIREMENTS

A. Engineered fire detection and suppression system that totally floods protected area with clean-agent fire extinguishing agent to extinguish fire.

1. Comply with NFPA 2001 and NFPA 72.
2. Fire Extinguishing Agent: Any allowed by NFPA 2001.
3. Locate extinguishing agent supply and backup supply in each protected area.
4. Locate manual release stations at each exit from protected area.
5. Locate abort stations at each exit from protected area.

6. Provide all manufactured system components from a single source and by a single manufacturer.
7. Provide components listed and labeled by ITS (DIR) or UL (DIR) for the type of system required and for use with the other components of the system.
8. System and Component Listings: FM (AG) and UL (DIR) for intended purpose.
9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose specified and indicated.
10. Permanently mark valves with manufacturer's name and pressure rating.

B. Engineered System Design Criteria:

1. Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume and initiated within 10 of automated fire detection or immediately upon manual station operation, supplied continuously for 10 minutes with 10 percent allowance for room leakage.
2. Provide minimum of two zone circuits in each contiguous protected space.
3. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient.
4. Use UL-listed flow calculation software.
5. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:

    a. Volume of protected area.
    b. Specific volume of fire extinguishing agent.
    c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.
    d. Forced ventilation, fan coast-down time, and damper actuation time where app.
    e. Mechanical smoke control system where applicable.
    f. Other special conditions affecting extinguishing agent concentration.

2.03 FIRE SUPPRESSION SYSTEM CONTROL PANEL

A. Provide system controller in the form of fire alarm system monitored, self-contained control panel or module.

B. Type: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.

C. Provide NFPA 72, Class A circuit supervision for wire break or ground faults of:

1. Zone detection loops.
2. Remote manual discharge stations.
3. Suppression system solenoid valves.
4. Power supply and circuit wiring and fuse.
5. Battery interconnecting wires and fuse.

6. Alarm in abort mode.

D. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.

E. Equip panel with following standard features:

1. Visual and audible annunciation of trouble or alarm signals.
2. Panel reset switch.
3. Trouble alarm silence switch with ring back feature.
4. Single Zone Detection: Cross zone.
5. Battery test meter and switch.
6. Manual discharge switch.
7. Deadman abort switch.
8. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
9. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
10. Relay contactors for general trouble signal.
11. Relay contactor activated by detector zone board in alarm or trouble mode.
12. Drift compensation.
13. Sensitivity test complying with NFPA 72, Chapter 5.
14. Maintenance alert feature.
15. System status report to display or printer.
16. Alarm verification with verification counter.
17. Presignal complying with NFPA 72 3-8.3.
18. Rapid (less than 2 seconds) manual station reporting.
19. Non-alarm points for general control.
20. Periodic, programmed detector self-test program software.
21. Pre-alarm advanced fire warning feature.
22. Detection: Capability of counting two detectors in alarm, two software zones in alarm or one smoke and one thermal detector in alarm.
23. March time and temporal coding.
24. Walk test with check for two detectors set to same address.
25. UL 1076 Security Monitor Points.
26. Control-by-time feature for non-fire operations with holiday schedule.
27. Automatic day or night adjustment of detector sensitivity.
28. Detector blink control for sleeping areas.

F. Annunciation: Provide the following annunciation:

1. Power On: Green.
2. System Trouble: Amber.
3. Battery Trouble: Amber.
4. Circuit 1 Trouble: Amber.
5. Circuit 2 Trouble: Amber.
6. Ground Fault: Amber.
7. Release trouble: Amber.

8. Alarm Circuit 1: Red.
9. Alarm Circuit 2: Red.
10. Agent Release: Red.
11. Alarm Silence: Amber.
12. Battery Polarity: Amber.
13. Abort Trouble: Amber.
14. Alarm Output Trouble: Amber.
15. Supervisory Trouble: Amber.

G. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.

H. BAS, BMS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet IP.

I. Initiating Devices:

1. Manual Pull Stations:

a. Semi-flush housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

1) Activate all audible and visual alarms.
2) Override any abort station or time delay function.
3) Activate all release and shutdown functions normally triggered by detectors or alarm system.
4) Engraved Sign or Label: Provide adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.

2. Manual System Abort Switch:

a. Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
b. Engraved Sign or Label: Provide adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.

3. Ionization Smoke Detectors:

a. UL (DIR) listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.

b. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
c. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.
d. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
e. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

4. Photoelectric Smoke Detectors:

a. UL (DIR) listed, NFPA 72, adjustable sensitivity, with LED light source including photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.
b. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.
c. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
d. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

5. Heat Detectors:

a. UL (DIR) listed, NFPA 72, micro-processor based, thermistor type, that responds to a fixed temperature with minimal thermal lag.
b. Electronically Addressable and Field Programmable: Resettable alert and alarm thresholds provide real-time value of current and local temperature when requested by operator.
c. Configuration Option: Prevention of inadvertent or spurious fire signatures from accidental discharge of agent via programmable alarm threshold.

J. Notification and Control Devices:

1. Alarm Bells: 24 VDC with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.
2. Alarm Horns: 24 VDC with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet, for mounting on 4 inch electrical outlet box.
3. Strobe Beacon: 24 VDC with system identification on strobe lens.
4. Dampers: Electrically Actuated Fire-Smoke Control Dampers; see Section 233300.

2.04 SPACE OR AREA SIGNAGE

A. Entrance Warning Sign: One warning sign at each entrance to protected area.

B. Exit Warning Signs: One lighted, flashing warning sign at each exit from protected area.

2.05 SYSTEM PIPING AND SPECIALTIES

A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, black.

1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.
2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.

B. Pipe Hangers: ASME B31.1, UL (DIR) approved listing for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.

C. Seismic Restraint Devices: Provide pipe hangers and isolators, see Section 210548.

D. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.

E. Gauges: ASME B40.100, UL 393, or UL 404; 3-1/2 inch in diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

2.06 CLEAN-AGENT CONTAINERS

A. Containers: Comply with ASME BPVC-VIII-1

1. Steel, red enamel finish; standard model and size for ease of replacement and addition.
2. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.

B. Contents: Fill with required fire extinguishing agent.

C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.

D. Safety Release: Equip with frangible disc safety device that operates when internal pressure exceeds 730 pounds per square inch.

E. Valves: Heavy duty forged brass, with safety pressure relief device, manual control, discharge valve, and pressure gauge.

1. Pressure relief device activated at between 3000 to 3360 pounds per square inch.

2. Provide a solenoid pilot valve for each container or each bank of containers.

F. Actuator: Resettable electric or pneumatic with pressurized nitrogen cartridge. Explosive devices are NOT permitted.

G. Pressure Gauge: Visual indicator of internal pressure.

H. Low Pressure Switch: Electronic sensor; reports to control panel and provides audible and visual alarms when container pressure drops below 230 psi.

I. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.

J. Wall Bracket: Manufacturer's standard; UL (DIR) listed, welded steel construction, modular design with saddle bottom and front bracket.

2.07 AGENT DISCHARGE NOZZLES

A. Nozzles: UL (DIR) listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.

B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.

C. Orifice Union Nipple Assemblies:

1. Construction: Manufacturer's standard, UL (DIR) listed.
2. Identification: Permanently marked with manufacturer's part number and UL (DIR) listing or FM (AG) approval.
3. Rating: 2,000 lb.

D. Identification: Permanently mark nozzles with manufacturer's part number, UL listing and equivalent single orifice diameter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

3.02 APPLICATIONS

A. Computer Room: Location of devices:

1. Smoke Detector: One at ceiling, and two below floor.
2. Heat Detector: Two at ceiling.
3. Abort Switch: Next to main entrance, left side.

4. Manual Release: Next to main entrance, right side.
5. Alarm Bell: Any suitable location.
6. Alarm Horn: Not required.

B. Location of devices:

1. Smoke Detector: One at ceiling, and two below floor.
2. Heat Detector: Two at ceiling.
3. Abort Switch: Next to main entrance, left side.
4. Manual Release: Next to main entrance, right side.
5. Alarm Bell: Any suitable location.
6. Alarm Horn: Not required.

3.03 FIRE SUPPRESSION OPERATING SEQUENCE

A. Actuation of one detector in either zone circuit:

1. Illuminate zone indicator.
2. Energize alarm bell.
3. Shut down air-conditioning system and close dampers.
4. Close doors to area.
5. Signal building fire alarm system.

B. Actuation of second detector on second zone circuit:

1. Illuminate zone indicator.
2. Energize alarm horn.
3. Shut down power to protected equipment.
4. Actuate time delay for up to 30 seconds.
5. Release extinguishing agent into protected area.
6. If abort switch is engaged, delay release.
7. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.

C. Discharge of Extinguishing Agent:

1. Sounds alarm bells and horns.
2. Operates strobes.

D. Temperature Detection:

1. Lower Temperature: Illuminate indicator and energize bell.
2. Higher Temperature: Shut down power to protected equipment.

E. High Temperature Detection: Close circuit to sprinkler pre-action valve.

3.04 INSTALLATION

A. Install in accordance with manufacturer's written instructions, standards referenced in PART 2 of this section, and NFPA 2001.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.

C. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.

D. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.

E. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.

F. Install unions downstream of valves and at equipment or apparatus connections.

G. Prepare pipe, fittings, supports, and accessories for finish painting, see Section 099123.

H. Identify in accordance with requirements of referenced standard.

1. Place directional arrows and system labels wherever piping changes direction and minimum 20 feet on straight runs.
2. See Section 210553.

I. Containers: Mount and anchor as indicated on drawings.

J. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot radius of the nozzles to prevent lifting during discharge.

K. Install wiring in compliance with NFPA 70, see Section 260583.

L. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.

M. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.

N. At hazard area walls pack space between pipe, pipe sleeve, or surface penetration with mineral fiber with elastomer caulk to a depth of 1/2 inch. Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations. See Section 078400.

O. Locate discharge nozzle approximately 6 inches above or below ceiling and 6 inches below raised floors. Avoid interference with other piping and equipment.

P. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.

Q. Mounting Height of Notification Devices: Between 72 to 80 inches above finished floor.

R. Locate extinguishing agent supply and backup supply in each protected area.

S. Locate manual release at each exit from protected area.

T. Locate strobe units at points of entrance to each protected area.

U. Locate abort station at points of exit from each protected area.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Provide interlock with automatic closing door releases, see Section 087100.

B. Integrate the system with pre-action sprinkler system, see Section 211300.

C. Provide interlock with fire-smoke or smoke control damper(s); see Section 233300.

D. Provide auxiliary alarm and trouble/fault signals to fire alarm system for supervisory monitoring, see Section 284600.

E. Remote Monitoring: Link auxiliary alarm and trouble/fault contacts to BAS, BMS, SCADA, or other Integrated Automation System; see Section 251500.

3.06 FIELD QUALITY CONTROL

A. Manufacturer Services: Provide experienced manufacturer's field engineer to supervise installation and performance testing of the system. Testing shall follow procedures identified in NFPA 2001 and described below.

B. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.

C. Test distribution piping and valving, prior to nozzle installation, to 50 psi air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.

D. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.

E. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.

F. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity and include record in test report.

G. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

H. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

3.07 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with the controls system.

B. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.

1. Arrange meeting prior to demonstration with representatives of Owner, Owner's underwriter, and the installer.
2. Perform visual inspection and overall review of system installed.
3. Place minimum of three UL-listed recording analyzers in space. Provide certification that testing devices have been checked by recognized testing authority within two weeks of date of demonstration.
4. Certify that replacement charge can be provided within 24 hours of demonstration.

C. Discharge system using manual-release switch mounted on control panel. Run discharge test with compressed nitrogen at 360 psi. After discharge, check for complete pressure release.

D. After satisfactory completion of discharge test, fill agent containers with amount of fire extinguishing agent specified in design calculations.

3.08 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide inspections and maintenance performed by competent personnel in the employ of the system installer.

D. Conduct inspections semi-annually of each system installed under this contract, during the system hardware manufacturer’s warranty period. to verify proper operation of system, check agent container weight and pressure, and a thorough check of controls, detection and alarm systems.

E. Remedy of all deficiencies shall be included at no extra cost to Owner except for replacement of agent due to discharge under normal use or damage due to abuse.

F. Submit documents certifying satisfactory system conditions. Include manufacturer's certificate of acceptance of inspector's qualifications.

END OF SECTION

SECTION 230130
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

B. Testing and inspection agency employed by Owner.

1.02 RELATED REQUIREMENTS

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

B. Section 014000 - Quality Requirements: Additional requirements for testing and inspection agencies.

C. Section 015719 - Temporary Environmental Controls.

D. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

E. Section 230800 - Commissioning of HVAC.

1.03 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system (RTU B177A and RTU B177B) , including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1. Above-ceiling plenum for supply air is required to be cleaned.
2. Above-ceiling plenum for return air is required to be cleaned.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

D. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Project Cleanliness Evaluation and Cleaning Plan, as specified.

D. Safety Data Sheets (SDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.

E. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.06 QUALITY ASSURANCE

A. Information Available to Contractor: Upon request, Owner will provide the following:

1. One copy of available original construction drawings of HVAC system.
2. Cleanliness inspection report performed by separate contractor.
3. Indoor air quality report performed by separate contractor.
4. Hazardous material report performed by separate contractor.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. Certified by one of the following:

a. NADCA, National Air Duct Cleaners Association: www.nadca.com.
b. Nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

2. Having minimum of three years documented experience.
3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

C. Testing and Inspection Agency Qualifications: Experienced in inspection and testing using methods defined in NADCA ACR.

1. See Section 014000 for additional requirements.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 REPLACEMENT PRODUCTS

A. Fibrous Glass Insulation: Provide material complying with UL 181 equivalent to existing material in quality and thickness.

2.03 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

B. Surface Coating for Fibrous Glass Materials: Water-based, zero VOC; flame spread index less that 25, smoke developed index less than 450, Class A, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Comply with requirements of Section 015719.

F. Obtain Owner's approval of proposed temporary locations for large equipment.

G. Designate a decontamination area and obtain Owner's approval.

H. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

I. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Architect a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

C. Start of cleaning work constitutes acceptance of existing conditions.

D. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

E. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.

1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Fibrous Glass Material: Use HEPA vacuuming equipment, under constant negative pressure, do not permit to get wet, and do not damage surfaces; replace material damaged by cleaning operations.

H. Existing Damaged Fibrous Glass Material: Report to Architect all evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture that cannot be remedied by cleaning or resurfacing with an acceptable insulation repair coating.

1. Material with active fungal growth is considered unremediable.
2. Remove unremediable material and clean underlying surfaces.
3. Where surface damage can be repaired by applying a coating, do so at no extra cost to Owner.
4. Replace unremediable material.

I. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

J. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect when cleaned components are ready for inspection.

E. Notify Owner's testing and inspection agency when cleaned components are ready for inspection.

F. Owner reserves the right to verify cleanliness using NADCA ACR Surface Comparison Testing or NADCA Vacuum Test.

G. When directed, re-clean components until they pass.

H. Contractor shall bear the costs of retesting due to inadequate cleaning.

I. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ANTI-MICROBIAL TREATMENT

A. When directed, apply anti-microbial treatment to internal surfaces.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

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SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

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

1.02 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

1. Associated Air Balance Council
2. American Boiler Manufacturers Association
3. Air Diffusion Council
4. American Institute of Architects
5. Air Movement and Control Association
6. American National Standards Institute
7. Air-Conditioning and Refrigeration Institute
8. American Society of Heating, Refrigerating and Air Conditioning Eng.
9. American Society of Mechanical Engineers
10. American Society for Testing and Materials
11. American Water Works Association
12. American Welding Society
13. Environmental Protection Agency
14. Factory Mutual
15. International Cable Engineers Association
16. Institute of Electrical and Electronics Engineers
17. Illuminating Engineering Society of North America
18. Industrial Risk Insurance
19. Instrument Society of America
20. Mechanical Contractors Association
21. Midwest Insulation Contractors Association
22. Manufacturer’s Standardization Society of the Valve & Fitting Industry
23. National Bureau of Fire Underwriters
24. National Bureau of Standards
25. National Environmental Balancing Bureau
26. National Electric Code
27. National Electrical Manufacturers Association
28. National Fire Protection Association
29. National Safety Council
30. Occupational Safety and Health Administration
31. Plumbing and Drainage Institute

32. Sheet Metal and Air Conditioning Contractors' National Association
33. Underwriters Laboratories
34. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
35. Standard Test Method for Surface Burning Characteristics of Bldg. Materials
36. Fire Tests of Through-Penetration Firestops
37. Surface Burning Characteristics of Building Materials

1.03 SUMMARY

A. This Section includes the following:

1. Definitions
2. Submittals
3. Extra materials
4. Codes and permits
5. Authority having jurisdiction inspections
6. Insurance
7. Commissioning and testing
8. Guarantee / Warranty
9. Quality Assurance
10. Delivery, storage, and handling
11. Coordination
12. Cutting and patching
13. Access Panels in walls and ceilings
14. System description
15. Existing conditions
16. Continuity of services and use of facility
17. Maintenance
18. Manufacturers
19. Access doors and frames for walls and ceilings
20. Pipe, tube, and fittings
21. Grout
22. Pipe escutcheons
23. HVAC demolition
24. Material and workmanship
25. Equipment
26. Piping and ductwork systems – common requirements
27. Piping joint construction
28. Piping connections
29. Equipment installation – common requirements
30. Painting and touchup
31. Grouting
32. Protection and cleaning
33. Training
34. Building commissioning

35. Interruption of existing HVAC service
36. Start-up
37. Testing, adjusting and balancing
38. Final field observation
39. Date of project completion

1.04 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations:

1. Exposed to view indoors. Examples include finished spaces occupied by the public.
2. Exposed to view in Mechanical Rooms. Examples include air handling unit service vestibules.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

H. Basic Contract definitions are as follows:

1. Provide: The term "provide" means "to furnish and install, ready for the intended use and in complete operating condition."
2. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring,

applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

3. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
4. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contracts.
5. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
6. Contractor: The term "Contractor" shall carry the same meaning as "HVAC Contractor" or “Division 23 Contractor”.
7. Or Equal: The term "Or equal" shall carry the same meaning as "approved as equal by the Engineer"
8. Supplied: The term “supplied” shall carry the same meaning of “provided”.
9. Others: The term refers to another entity or another contractor other than the “HVAC Contractor or “Division 23 Contractor”
10. Owner: All references here-in and on drawings to “Owner” shall be the same as “Rockwall ISD”.
11. Contract Documents: References to Contract Documents refers to a complete set of Drawings and Specifications for the entire Project. Drawings and Specifications are intended to supplement one another.
12. Dimensions: Arrangement of equipment, accessories, piping and ductwork on the Drawings is generally diagrammatic unless the Drawings include dimensions. Do not scale the Drawings. Field verify all dimensions at the site to locate new and existing work.
13. Furnish: To obtain, coordinate, submit the necessary drawings, deliver to the job site in new condition ready for installation, unload and unpack, and guarantee.
14. Responsibility: Where verbs such as “furnish”, “provide”, “install”, or “use” appear in the Contract Documents, they mean, “The HVAC Contractor shall furnish, provide, install, or use…..” unless the requirement is introduced by a phrase, sentence or heading specifically identifying the requirement as the responsibility of someone else.

1.05 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Sections.

B. Substitutions:

1. Submittal dates: For a period of up to ten (10) days prior to bid date, Engineer will consider written requests from bidders, manufacturers, and suppliers for substitution of products.

2. Submission: Submit a separate request for each product, supported with descriptions, drawings and samples as appropriate, including:

    a. Comparison of the qualities of the proposed substitution with that specified. Standard features and options of the proposed substitution shall be clearly identified on the submittal.
    b. Changes required in other elements of the work because of the substitution.
    c. Availability of maintenance service, and source of replacement materials.

3. Substitution request constitutes a representation that bidder submitting request:

    a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
    b. Will provide the same warranties or bonds for the substitution as for the product specified.
    c. Will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects.
    d. Waives all claims for additional costs, under his responsibility which may subsequently become apparent.

4. Engineer Review: The Engineer will review requests for substitutions with reasonable promptness to judge the acceptability of the proposed substitution, and notify bidders by addendum the decision to accept the requested substitution. Substitution requests not indicated in addendums are considered rejected and not allowed.
5. Late Request for Substitutions: Requests for substitution received after bidding will not be considered except in such cases where it is necessary to make a substitution due to strikes, lockouts, bankruptcy, discontinuing of a product, etc. Requests for such substitutions of materials after award of contract shall be made in writing to Engineer and shall be made within ten days of date that Contractor ascertains he cannot obtain material or equipment specified.
6. Engineer’s Acceptance: Engineer's acceptance of a substituted item applies only to the general quality and arrangement of the items substituted. Substituted items are still subject to compliance with the specification requirements and the shop drawing review process.
7. Cost Adjustment: Contractor to bear all added costs associated with substituted items, including costs incurred by other contractors. Cost savings associated with substitutions shall be refunded to the Owner.
8. Contractor is responsible for dimensional differences, weights, electrical requirements and any other resulting changes, when using equipment other than that scheduled on the Drawings. Contractor is responsible for any additional costs incurred as a result of substitutions, including other Contractors and Architect/Engineer fees.

9. Material and equipment not listed in the Specifications nor accepted in an Addendum will be removed and replaced at no cost or inconvenience to the Owner.

C. Shop Drawings:

1. Before ordering any equipment, review and stamp with submitting contractor approval, and submit electronically to the Architect/Engineer for review.
2. The review of shop drawings by the Architect/Engineer shall not constitute agreement of any deviations from the plans and specifications and shall not relieve the Contractor from responsibility for errors or omissions.
3. Submit all shop drawings a maximum of 1 month from date of contract award.
4. Shop drawings shall be in electronic copy format as follows:

    a. All shop drawings shall bear the submitting contractors approval stamp.
    b. Electronic copies (digital copies) of shop drawings shall be in Adobe Acrobat Portable Document Format - *.pdf format.

5. Submit for all equipment and systems as indicated in the respective specifications sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.
6. Include project name, name of Architect, name of Engineer, contractor, sub-contractor, manufacturer, supplier and sales representative, include name, address, and phone number for the sales representative. Clearly identify section number and description of equipment submitted.
7. Examine all shop drawings noting capacity, arrangement and physical dimensions. Clearly mark all relevant items on catalog data and cross-out unrelated information. Review and stamp shop drawing prior to submitting to the Engineer.
8. Before submitting electrically powered equipment, verify that the electrical power and control requirement for the equipment are in agreement with the schedules on the drawings. Include a statement of the shop drawing transmittal to the Architect/Engineer that the equipment submitted and the schedules are in agreement or indicate any discrepancies.
9. Refer to drawings and specifications for the additional required equipment that is to be submitted as part of the shop drawing submittals.
10. All shop drawings must be reviewed and accepted by the Engineer prior to fabrication and installation.
11. Submittals will be reviewed with the following actions:

    a. NO EXCEPTIONS TAKEN - Indicates the Submittal appears to conform to the design concept of the Work and that the Contractor at his discretion, may proceed with fabrication and/or procurement and installation.

b. NOTE MARKING - Indicates that the Submittals, after noted corrections are made, would appear to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
c. REVISE AND RESUBMIT - Indicates that the Submittal does not appear to conform to the specifications, and that the submittal needs to be changed to reflect the items noted. The Contractor shall not proceed with fabrication or procurement.
d. REJECTED - Indicates that the Submittal does not appear to conform to the specifications, and that a complete resubmittal is required. The Contractor shall not proceed with fabrication or procurement.
e. SEE ATTACHED COMMENTS - Indicates that the Submittals, after attached comments are made, would appear to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.

12. Allow a minimum of fourteen (14) calendar days for the Engineer to review the shop drawings. Time is from the receipt of drawings in the Engineers office until they are shipped out of the office.

D. Payment Request Breakdown:

1. For the purpose of establishing a schedule of values to be used for Application and Certification for Payments as defined in the General Conditions of the specifications, the items of HVAC work shall be broken down. Each item of schedule shall contain its proper share of overhead and profit and shall be broken into a labor and material figure.
2. Submit the schedule of values to the engineer prior to first payment request.

E. Project Record Documents:

1. As work progresses: Record changes or deviations from the contract drawings as follows:

a. Record location and elevation of underground buried piping.
b. Record as-built changes for HVAC work within the building that occur during the progress of construction and before the work is concealed. Record shall include such changes as:

1) Relocation of valves or piping to avoid obstacles.
2) Routing of piping overhead, in walls or exposed.
3) Locations of balancing and service valves.
4) Sizes of piping.
5) Revisions to HVAC system reflecting as-built conditions.

2. Location: The record drawings shall be maintained at the job site and be subject to review by the Owner or Engineer during the construction period. Prints for this purpose may be obtained from the Architect at cost. This record keeping requirement shall not be construed as authorization for the Contractor to make changes in the layout without definite instructions by the Architect/Engineer in each case.
3. Submission: Upon completion of the work, a set of drawings showing changes as noted on the record set of prints shall be submitted to the General Contractor or Construction Manager.

F. Operating and Maintenance Manuals:

1. Submittal: At the completion of the contract submit to the Owner one digital copy of operating and maintenance manuals with folder structure and naming including parts lists for the division 23 equipment, systems, and materials. Digital copies shall be in Adobe Acrobat Portable Document Format - *.pdf format. Information not definitely applying to these particular pieces of equipment shall be crossed out or deleted from the submission. Information shall be included for equipment for which shop drawings have been provided.
2. All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 General Requirements.

    a. Approved shop drawings or product data sheets alone are not to be considered as acceptable maintenance material.
    b. In addition to the data indicated in the General Requirements, include the following information:

        1) Copies of all approved shop drawings
        2) Installation manuals
        3) Manufacturer’s wiring diagrams for electrically powered equipment.
        4) Records of tests performed to certify compliance with system requirements.
        5) Certificates of inspection by regulatory agencies
        6) Temperature control record drawings and control sequences
        7) Parts lists for manufactured equipment
        8) Valve schedules
        9) Lubrication instructions, including list/frequency of lubrication done during construction
        10) Warranties
        11) Additional information as indicated in the technical specification section.
        12) Operating instruction for equipment
        13) Recommended maintenance schedules and procedures for equipment
        14) Recommended trouble shooting procedures for equipment
        15) Settings/adjustments/calibrations for systems as required
        16) Local equipment suppliers/reps names, addresses, and telephone numbers

17) Equipment manufacturers names, addresses, and telephone numbers
18) Sub-contractors names, addresses, and telephone numbers
19) Test reports
20) Test and balance reports
21) System validation reports
22) Statement from Contractor that all incomplete items noted in Engineer's Final Field Observation Report have been completed
23) Statement from Owner confirming completion of Training
24) Refer to individual Specification Sections in for additional requirements

c. Special warranties.

G. Hazardous Materials: Disposal Certificates.

H. Welding certificates.

1.06 EXTRA MATERIALS

A. Refer to individual Specification Sections for extra materials to be provided to the Owner.

1.07 CODES AND PERMITS

A. The HVAC system shall be designed and installed in compliance with state code and local code for HVAC systems.

B. Obtain and pay fees for all licenses, required permits, and charges for use of outside services (i.e. inspecting agencies or delivery services) and use of property other than the site of the Work for storage of materials or other purposes.

C. Regular inspections shall be arranged by the Contractor as required by any and all regulations. All charges for inspections by regulating agencies of installations or review of plans and specifications shall be paid by the Contractor.

1.08 AUTHORITY HAVING JURISDICTION INSPECTIONS

A. Secure regular inspections as required by State and local regulations. Pay charges by regulating agencies for Drawings, Specifications, review of Drawings and Specifications, and the inspections of installations.

1.09 INSURANCE

A. Procure and maintain such insurance required by law and additional insurance as specified in Division 0 or 1 or as required by the general contractor.

1.10 COMMISSIONING AND TESTING:

A. Provide field Commissioning and testing of HVAC systems as defined in Section 230800 Commissioning of HVAC and individual 23 series Sections.

1.11 GUARANTEE/WARRANTY

A. The HVAC system installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year unless a longer period is specified elsewhere, from **date of acceptance by the Owner**except materials not furnished by the Contractor.

B. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished on special equipment, indicated.

1.12 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. All drawings, specifications and documents for this project shall be taken as a whole. Prior to installation, the Contractor shall be familiar with this project by carefully reviewing and comparing all documents that pertain to this project.

D. In preparation of the contract documents, a reasonable effort has been made to provide layouts and connections based on selected and specified manufacturer's equipment. Since physical space, HVAC connections, equipment arrangements and other requirements may vary according to each manufacturer, the final responsibility for connections, initial access and proper fit is the responsibility of the Contractor.

E. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the HVAC installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
2. Sleeves through fire rated floors and walls shall be non-combustible.

F. Sequence, coordinate, and integrate installing HVAC materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

G. Electrical Characteristics for HVAC Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

H. Regulatory Requirements: Compliance with the current adopted version of the applicable national, state, and local codes and referenced industry standards and specifications including:

1. American Society of Mechanical Engineers Unfired Pressure Vessel Code
2. American National Standards Institute (ANSI)
3. Americans with Disabilities Act
4. Municipal Water and Sewer Regulations
5. National Electrical Code (NEC)
6. National Fire Protection Association Codes (NFPA)
7. Occupational Safety and Health Administration (OSHA)
8. State and Local Building Codes
9. State and Local Electrical Codes
10. State and Local Fire Codes and Regulations
11. State and Local Mechanical Codes
12. State and Local Plumbing Codes
13. State Industrial Commission Regulations
14. State Energy Code
15. Uniform Federal Accessibility Standards
16. Meet or exceed all current applicable codes, ordinances and regulations for all installations. Promptly notify the Engineer, in writing, if the contract documents appear to conflict with governing codes and regulations.
17. Higher quality of workmanship and materials indicated in the Contract Documents takes precedence over that allowed in referenced codes and standards.

I. Agency Approvals: Demonstrated by seal, label, or stamp whenever these Specifications, referenced standards, or regulatory agencies require materials and equipment to conform to requirements of an inspection and testing agencies.

J. Standard for Materials and Workmanship: New materials, free of defects, installed in accordance with manufacturer's current published recommendations, in neat manner, and in accordance with recognized standard industry practice.

K. Equipment Nameplates: Permanently attached to each major equipment component including manufacturer's name, model and serial numbers, and address.

L. Noise and Vibration: Limited to levels not objectionable to occupants and not detrimental to Owner operations, by balancing rotating and reciprocating equipment, and use of vibration isolating and noise abating products and installation procedures.

M. Layout of Work:

1. Install equipment and run pipes parallel with and at right angles to lines of building unless shown otherwise on Drawings.
2. Lay out Work and be responsible for lines, elevations and measurements required for installation. No additional compensation will be provided for lack of coordination and installation.
3. Offset piping and duct works as required for coordination and installation of work.
4. Prepare coordination drawings for ductwork, piping, and equipment.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Deliver ductwork with end caps. Maintain end caps through shipping, storage, and handling to prevent damage and to prevent entrance of dirt, debris, and moisture.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.14 COORDINATION

A. Arrange for pipe and duct spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, registers, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

D. Coordinate work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor’s work shall be removed or relocated at the installing contractor’s expense.

1.15 CUTTING AND PATCHING

A. Each trade shall perform all cutting and patching necessary in order to perform his work unless such work has been delegated to the General Contractor. However, special permission shall be obtained from the Engineer before cutting structural members or finished material. All patching shall be performed in such manner as to leave no visible trace and to return the part affected to the condition of undisturbed work. Patching work shall be performed by persons experienced, skilled and licensed for the particular type of work involved. Inferior work will not be accepted. Pipe or duct

penetrations through new or existing floors and walls, regardless of type of construction, should be done by rotary drill, wet or dry method. Use of a pneumatic impact tool is not acceptable. Contractor to contain water and dust to avoid damage to adjacent finishes, furniture and equipment.

B. Pavements, sidewalks, roads and curbs shall be cut, patched, repaired and replaced as required to permit the installation of the work of each trade. Such cutting, patching, repairing and replacing shall be the responsibility of and paid for by the trade requiring the work.

C. Each trade shall bear the expense of all cutting, patching, repairing, or replacing of the work of other trades required because of his fault, error, or tardiness or because of any damage done by him.

D. Holes Through Masonry and Concrete:

1. Each trade shall provide all holes and openings required for his work unless such holes and openings are shown to be provided on the architectural or structural drawings. Pay particular attention to openings required in pre-cast, pre-stressed, or post-tensioned slabs.
2. Holes made in the field shall be core drilled large enough to allow all pipe insulation to continue uninterrupted. Holes in floors or exterior walls above grade shall include a steel pipe sleeve grouted watertight.

    a. The above method shall be employed whenever holes are made on the job including holes required by change orders or because of omissions made inadvertently by the trade.

3. Pipe openings in exterior walls below grade between earth areas and interior spaces shall include a steel pipe sleeve and a mechanical seal.
4. Each trade shall be responsible for providing and disposing of water he uses in the core drilling operation. Such work shall be scheduled and other trades coordinated so that damage will not result from the use of water.
5. Each trade shall be responsible for grouting air-tight any openings adjacent to his work to seal against the passage of air, smoke vapors or sound.

E. Entry of Equipment

1. Make all provisions for the entry of equipment provided under contract to the indicated locations. Provide all openings in the building, if necessary, and do all excavating, backfilling and repair necessary.
2. Break down equipment as required to allow entry of equipment into the building.

1.16 ACCESS PANELS IN WALLS AND CEILINGS

A. Access panels shall be furnished by the trade requiring them and delivered to the General Contractor for installation by them. Provide anticipated quantity of access

panels required to the General Contractor at time of bidding. Coordinate size and location of installation to allow for proper access.

B. Access Panel Locations:

1. Access shall be provided to any type of valve, trap, manual vent, control valve, damper etc. that requires adjustment, replacement, or visual inspection.
2. Each trade shall consult with the General Contractor to coordinate the location of each access panel.
3. Generally, access panels are not required when a lay-in-ceiling is installed. However, depending on the type of occupancy, the Engineer may require that access areas be identified.

1.17 SYSTEM DESCRIPTION

A. Design Requirements:

1. Division 21, 22, and 23 Specifications and Drawings are complementary and together define scope of Work for mechanical systems.

a. Indicated Work includes furnishing all labor, material and equipment, which is necessary for successful operation of all mechanical systems as shown on drawings and as specified, except as such items as are specifically noted as being furnished under other sections of specifications.
b. Drawings and specifications are to be considered as supplementing each other. Work specified but not shown on drawings, or shown on drawings but not specified, shall be performed or furnished as though mentioned in both specifications and drawings. If not otherwise directed, installation of all systems and equipment shall be in accordance with applicable codes and in accordance with manufacturer’s installation instructions. Where work described in the specifications is in conflict with the work shown on the drawings, the contractor shall supply the greater quantity, quality and cost via the bid and contact the Engineer for clarification on direction prior to installation.

2. Drawings are diagrammatic and are not intended to be scaled. Drawings are a graphic representation of contract requirements, produced according to best available standards to an optimum scale. Dimensions of work as indicated on plans are not guaranteed to be as-built dimensions. No measurements shall be scaled from drawings and used as a definite dimension for layout or fitting work in place.
3. Offsets, Fittings, and Accessories are not shown when precluded by Drawing production techniques or scales. Provide accessories and offset fittings required for completed installation of fully functioning and coordinating systems.
4. Clarifications: Requested from Engineer prior to bidding when Contractor is uncertain of requirements.

B. Performance Requirements:

1. Dimensions: Taken from Architectural and Structural Drawings, certified equipment drawings and from structure itself before fabricating Work.
2. Space Requirements: Verified and coordinated with other trades prior to fabrication and installation of Work. Give consideration to work by all contractors associated with the project and organize the work so that it will not interfere with work of other trades. Consult the drawings and specifications for work to be provided by other trades for correlating information, and the architectural and structural drawings for details, dimensions, foundations, pits, etc. The contractor shall verify all dimensions and conditions before starting their work.
3. Manufactured material specified or shown on drawings shall be installed or applied according to manufacturers' directions unless specifically designated otherwise.

1.18 EXISTING CONDITIONS

A. Visit premises and determine existing conditions before submitting a proposal or bid.

B. Before submitting a proposal or bid on the work outlined in this specification and accompanying drawings, each bidder shall examine the site and check as to the means of making connections to services and shall familiarize themselves with all the existing conditions and limitations. No additional compensation will be allowed because of the Contractor's misunderstanding as to the amount of work involved or his lack of knowledge of any site conditions that may affect his work. Any apparent variance of the plan or specification from the existing conditions at the site shall be called to the attention of the Engineer during the bid period so clarification can be made by addendum. Additional compensation will not be authorized because of conditions determinable prior to bidding without excavation, demolition, or precise measurement.

C. The existence of any wires, conduits, pipes, ducts, or other facilities are shown in a general way only. It will be the responsibility of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to the submission of his or her bid. It is understood that he or she will be responsible for making the exact determination of the location and condition of such facilities.

D. The location and routing of new systems and equipment shall be coordinated by the subcontractor with the mechanical, plumbing, fire protection, electrical and communication systems existing within the building. The subcontractor shall conduct a complete and detailed field survey prior to locating and installing new electrical services included in this contract. The routing and location of all new mechanical, plumbing and fire protection system services shall be approved by the Owner prior to installation.

1.19 CONTINUITY OF SERVICES AND USE OF FACILITY

A. The building will be in use during these operations, and each trade shall schedule his work and carry it out in such a manner as to least inconvenience the occupants due to interruption of mechanical services. Interruptions shall be confined to the smallest area possible at any one time and all interruptions shall be approved by the Owner. Temporary connections shall be made if required to provide continuity of service.

1. Procedures for Interruption of Owner's Operations:

a. Permission: Obtained from Owner before disruption of existing facility occurs.
b. Scheduled: Between the hours of 6 PM and 6 AM unless otherwise approved by Owner.
c. Duration: Limited to time periods approved by Owner by assigning adequate sized crews and using overtime compensation as required.

B. After service has been restored following an interruption, each trade shall inspect all areas affected by the interruptions and be responsible for returning all services to the same operating condition which existed prior to the interruption.

C. The normal use of the facility shall not be disturbed, except within the immediate construction area. All walks, driveways and entrances shall be kept clear and free of all Contractors' equipment, material and debris at all times.

1.20 MAINTENANCE

A. Maintenance Service: During warranty period for defective workmanship and material.

1. Emergency Service: Provide immediate, 24-hour response.
2. Normal Service: Non-emergency service may be performed during normal working hours.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers:

1. Access Panel Solutions.
2. Acudor Products, Inc.
3. Alfab, Inc.

4. Babcock-Davis.
5. Cendrex Inc.
6. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
7. Jensen Industries; Div. of Broan-Nutone, LLC.
8. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. Maxam Metal Products Limited.
12. Metropolitan Door Industries Corp.
13. MIFAB, Inc.
14. Milcor Inc.
15. Nystrom, Inc.
16. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Door Size: As required to access mechanical items concealed behind door.
3. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, Factory Finish.
4. Frame Material: Same material, thickness, and finish as door.
5. Manufacturer standard hinge.
6. Lockable hardware.

2.03 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.04 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.05 PIPE ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening

C. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
3. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
6. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
7. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.

D. Escutcheons for Existing Piping:

1. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
2. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
5. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
6. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

PART 3 EXECUTION

3.01 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. The drawings do not necessarily indicate all the conditions, details, or work required. The Mechanical Contractor shall examine the building to determine the actual conditions and extent of the work. Any details not clear to this Contractor shall be referred to the Architect/Engineer for clarification prior to bidding.

C. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed or made obsolete by new work. HVAC systems, equipment, and components within or routing through areas indicated for demolition but not

serving areas indicated for demolition shall not be disturbed and shall remain in service. Questions regarding applicability of or extent of demolition shall be brought to the attention of the engineer during bidding. Questions or uncertainty arising during construction shall be brought to the attention of the engineer and owner prior to demolition.

1. Piping indicated to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping indicated to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ductwork indicated to Be Removed: Remove portion of duct indicated to be removed and cap remaining duct with same material.
4. Equipment indicated to Be Removed: Disconnect and cap services and remove equipment.
5. Equipment indicated to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
6. Equipment indicated to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

D. Disposition of Removed Materials:

1. Do not reuse removed materials unless explicitly permitted by Documents.
2. Use of Owner's dumpsters for the disposition of any type of construction debris is not allowed.

E. Equipment indicated to remain Owner's property:

1. Place in storage location designated by Owner.

F. If pipe, insulation, ductwork or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

G. Where demolition work is to be performed adjacent to existing work that remains in an occupied area:

1. Construct temporary dust partition to minimize the amount of contamination of the occupied space.
2. Provide temporary connections necessary to permit the Owner to occupy areas of the building to remain in use during construction.

H. Where pipe or duct is removed and not reconnected to new work, cap end of existing services as if they were new work

3.02 TEMPORARY SERVICES

A. New or existing HVAC systems may not be used for temporary heating and ventilating. All HVAC systems shall be cleaned prior to substantial completion.

B. New or existing cooling systems shall not be used for temporary cooling or dehumidification.

3.03 MATERIAL AND WORKMANSHIP

A. Provide new material and equipment, unless noted otherwise. Protect equipment and material from damage, dirt and the weather.

B. Provide the highest quality workmanship and perform all work only by skilled mechanics. Install material and equipment in accordance with manufacturers' recommendations, instructions and current standards.

C. The Engineer reserves the right to reject material or workmanship not in accordance with the Contract Documents, before or after installation.

3.04 EQUIPMENT

A. Install material and equipment in accordance with the manufacturer's written instructions.

3.05 PIPING AND DUCTWORK SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

P. All piping and ductwork shall be run in the most direct and straight manner possible maintaining proper grading.

Q. It is the intent of these plans and specifications that most piping and ductwork be concealed. Where exposed, run as close to ceiling and/or wall as possible parallel with adjacent structural or architectural elements.

R. Do not install piping or ductwork in any switchgear, transformer, elevator equipment, telephone, or electrical equipment room, unless it is a branch serving that room.

S. Do not install piping or ductwork above switchboards, panelboards, control panels, motor control centers, etc.

T. Arrange work to facilitate maintenance, repair or replacement of equipment. Provide access for devices that require maintenance. For concealed devices, verify that access panels are properly located and labeled.

3.06 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

3.07 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

B. Drain Lines from Equipment:

1. Unless otherwise noted, each item of equipment requiring a drain line’ a conductor for liquid shall be provided to an "open site" drain, such as a standpipe, floor drain, or a janitors sink. Direct connection to existing or new waste and vent stacks or rainwater leaders is not acceptable.

C. HVAC drain piping in finished spaces shall be copper unless specified otherwise. Provide a liquid trap in the piping to provide gas seal.

D. HVAC Contractor shall also provide drains on other items of equipment as required by the manufacturer.

3.08 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.09 PAINTING AND TOUCHUP

A. Painting of HVAC systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Refinish and touch up paint:

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

5. Paint exposed piping to match painted surfaces.

3.10 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.11 PROTECTION AND CLEANING

A. Protection

1. Protect openings and equipment from obstruction, breakage, misuse, damage or blemishes. Protect materials and equipment immediately upon receipt at the job site or immediately after they have been removed from their shipping containers. Unless noted otherwise, keep them clean and undamaged until final acceptance of the entire Project by the Owner. When a portion of the building is occupied by the Owner before substantial completion of the entire Project, make arrangements to transfer responsibility for protection and housekeeping for the occupied portion.
2. Protect pipe, duct and equipment openings with temporary plugs or caps. Keep openings covered until permanent connections are complete.
3. Contractor is responsible for any damage to mechanical equipment, materials or work until final acceptance of the entire project by the Owner.

B. Progress Cleaning:

1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

    a. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
    b. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

c. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

1) Use containers intended for holding waste materials of type to be stored.

d. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

2. Site: Maintain Project site free of waste materials and debris.
3. 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.

4. 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.
5. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
6. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
7. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Sections.
8. 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.
9. 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.
10. 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.

C. Final Cleaning:

1. Thoroughly clean HVAC materials, equipment and apparatus to be free of dust, dirt, rust, and foreign materials before acceptance at Substantial Completion.

2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.12 TRAINING

A. General: Instruct Owner's personnel in proper operation and maintenance of mechanical systems.

1. Comply with Division 01 Section "Demonstration and Training."

B. Classroom Sessions: Used to introduce Owner's operation, maintenance, and management personnel to manuals, drawings, and other documents and aids available to operate and maintain mechanical equipment and systems.

C. Factory Specialists: Used in area of major equipment and systems to present sessions on their specific equipment and systems.

D. Hands-On Training: Conducted concurrent with functional performance testing and commissioning.

E. Video Record: Record training sessions and submit a digital copy for Owner's use.

F. Provide video documentation of the above ceiling location of all controlled devices prior to ceiling installation.

G. Training Hours: Provide training as required to familiarize Owner with component location and function. A minimum of 8 hours shall be provided.

H. Include documentation of instructions in the Operation and Maintenance Manuals.

I. Obtain a written statement from the Owner that his designated personnel have been instructed.

3.13 BUILDING COMMISSIONING

A. Coordinate required commissioning work of this section with Owner’s Commissioning Agent and other commissioning-related sections for commissioning requirements and roles required in this project.

B. Provide assistance as required support commissioning activities

3.14 INTERRUPTION OF EXISTING HVAC SERVICE

A. The existing building will be in use during construction. Schedule and carry out the Work in such a manner as to cause the Owner a minimum of inconvenience due to service interruption. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled in advance with the

Owner's site representative. All interruptions shall be conducted and shall be limited to afterhours 9:00 pm – 6:00am and weekends, or as directed by the Owner. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning HVAC system to the same operating condition which existed prior to the interruption.

B. Notify the Owner a minimum of 7days prior to service interruption.

3.15 START-UP

A. Before start-up, lubricate, charge, and fill systems as specified and according to Manufacturer's instructions.

B. Test hydronic systems and air systems as specified in Sections governing their installation.

C. Perform testing, adjusting and balancing in accordance with that Section.

D. Operate equipment and systems in all their operating modes, to verify proper operation, prior to final field observation and Owner instructions. Notify the Engineer, in writing, that all systems have been tested and are functioning and operating properly.

3.16 TESTING, ADJUSTING AND BALANCING

A. Attend pre-testing conference as scheduled by Testing, Adjusting and Balancing Contractor.

B. Provide assistance to Test, Adjusting and Balancing Contractor by making adjustments to system and system components required for achieving design performance.

C. If acceptable performance of any test is not achieved, make the necessary corrections and the test shall be repeated until acceptable performance is achieved.

3.17 FINAL FIELD OBSERVATION

A. A final field observation of the mechanical systems will be required before Contract Closeout. Request a final observation by the Engineer after all systems are fully completed and operational. The Engineer will schedule a field observation and generate a list of items to be corrected or completed before Contract Closeout.

3.18 DATE OF PROJECT COMPLETION

A. The date for the final performance and acceptance testing shall comply with the Schedule and shall be sufficiently in advance of the Date(s) of Project Completion to permit the execution of the testing by the Subcontractor prior to occupancy and the closeout of the Construction Contract. Any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper and satisfactory functioning

of all equipment and systems, shall be completed prior to the closeout of the Construction Contract. Retests shall not relieve the Subcontractor of completion date responsibility.

B. The Contractor shall provide in the Schedule dates when each system is to be completed and outlining when tests will be performed.

END OF SECTION

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SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Three phase electric motors.

1.02 RELATED REQUIREMENTS

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

B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

C. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

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.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

E. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

F. Operation Data: Include instructions for safe operating procedures.

G. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Comply with NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for motors larger than 15 horsepower.

1.08 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Refer to drawing equipment schedules for specific motor voltage, phase, and hertz. When not indicted on the drawing equipment schedules, refer to the below.

    a. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
    b. Motors Larger than 1/2 Horsepower: 208 or 460 volts, three phase, 60 Hz.

B. Nominal efficiency classified as premium efficiency as defined by NEMA MG 1:

C. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Motors with frame sizes 254T and larger: Energy efficient type.

D. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

F. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

G. Motor Bearing Protection: Provide bearing protection ring to protect motor bearings from VFC induced electrical bearing fluting failure.

1. Provide insulated bearing journal or provide ceramic bearing on the non-drive end of the motor.
2. Provide maintenance free, circumferential, conductive fiber shaft grounding ring installed on the motor to discharge shaft currents to ground.
3. Bearing protection ring shall be suitable for installation on either the drive end or the non-drive end of the motor in accordance with the manufacturer’s installation instructions.
4. Install a colloidal silver shaft coating to improve shaft conductivity at the shaft grounding ring location.
5. Manufacturer and Model: AEGIS SGR Bearing Protection Ring or approved equal.

H. Motors used on Variable Frequency Drives:. Motor shall comply with NEMA MG1 Part 31 to provide windings capable to withstand up to 1600 peak Volts with a rise time of 0.1 µs.

2.02 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

C. Motors located in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.03 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 262913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Where motor is located outdoors or in a contaminated air stream, provide weatherproof Epoxy Sealed Motors. Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 ELECTRICAL COORDINATION

A. Electrical drawings and/or specifications show number, and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor.

B. Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

C. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator.

E. When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

F. Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

G. Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

3.03 SCHEDULE

A. NEMA Motor Service Factors

NEMA MOTOR SERVICE FACTORS				
Motor HP	Nominal Motor Speed			
	900 RPM	1200 RPM	1800 RPM	3600 RPM
1/6 to 1/3	1.35	1.35	1.35	1.35
1/2	1.15	1.25	1.25	1.25
3/4	1.15	1.15	1.25	1.25
1	1.15	1.15	1.15	1.25
1.5-150	1.15	1.15	1.15	1.15

B. Three Phase - Energy Efficient, Open Drip-Proof Performance:

Three Phase - Energy Efficient, Open Drip-Proof Performance									
Motor HP	Nominal Motor Speed								
	1200 RPM			1800 RPM			3600 RPM		
	NEMA Frame	Min % Power Factor	Min % Eff.	NEMA Frame	Min % Power Factor	Min % Eff.	NEMA Frame	Min % Power Factor	Min % Eff.
1	145T	72	81	143T	84	82	-	-	-
1.5	182T	73	83	145T	85	84	143T	85	82
2	184T	75	85	145T	85	84	154T	87	82
3	213T	60	86	182T	86	86	145T	85	84
5	215T	65	87	184T	87	87	182T	86	85
7.5	254T	73	89	213T	86	88	184T	88	86

10	256T	74	89	215T	85	89	213T	86	87
15	284T	77	90	256T	85	91	215T	89	89
20	286T	78	90	256T	86	91	254T	89	90
25	324T	74	91	284T	85	91	256T	92	909
30	326T	78	91	286T	88	92	284T	91	91
40	364T	77	93	324T	83	92	286T	92	92
50	365T	79	93	326T	88	93	324T	89	93
60	404T	82	93	364T	88	93	326T	91	93
75	405T	80	93	365T	88	93	364T	88	93
100	444T	80	93	404T	83	93	365T	88	92

C. Three Phase - Energy Efficient, Totally Enclosed, Fan Cooled Performance:

Three Phase - Energy Efficient, Totally Enclosed, Fan Cooled Performance									
Motor HP	Nominal Motor Speed								
	1200 RPM			1800 RPM			3600 RPM		
	NEMA Frame	Min. % Power Factor	Min. % Efficiency	NEMA Frame	Min. % Power Factor	Min. % Efficiency	NEMA Frame	Min. % Power Factor	Min. % Efficiency
1	145T	72	81	143T	84	82	-	-	-
1.5	182T	73	83	145T	85	84	143T	85	82
2	184T	68	85	145T	85	84	145T	87	82
3	213T	63	86	182T	83	87	182T	87	82
5	215T	66	86	184T	83	88	184T	88	85
7.5	254T	68	89	213T	85	89	213T	86	86
10	256T	75	89	215T	84	90	215T	86	87
15	284T	72	90	256T	86	91	254T	91	88
20	286T	76	90	256T	85	91	256T	89	89
25	324T	71	90	284T	84	92	284T	92	90
30	326T	79	91	286T	86	93	286T	92	91
40	364T	78	92	324T	83	93	324T	91	91
50	365T	81	92	236T	85	93	326T	92	90
60	404T	83	92	364T	87	93	364T	93	91
75	405T	80	92	365T	87	93	365T	91	91

100	444T	83	93	405T	86	94	405T	92	92
125	444T	85	93	444T	87	94	-	-	-

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. 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.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

N. FM (AG) - FM Approval Guide; Current Edition.

O. MFMA-4 - Metal Framing Standards Publication; 2004.

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

Q. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. UL (DIR) - Online Certifications Directory; Current Edition.

S. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable codes.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of the work depicted or defined.

B. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Fire Resistance: Provide hardware rated for 60 minutes resistance unless specifically indicated by the authority having jurisdiction.

2.02 NONPENETRATING ROOFTOP SUPPORTS - LOW TYPE:

A. Manufacturers:

1. Anvil International, LLC; H-Block with steel channel.
2. B-Line, a brand of Eaton Corporation; Dura Block.
3. Erico International Corporation, a brand of Pentair.
4. Green Link, Inc.
5. PHP Systems/Design.
6. Unistrut, a brand of Atkore International Inc.
7. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

B. Provide horizontal pre-galvanized ASTM 653 minimum 14-gauge galvanized channel mounted to a UV resistant thermoplastic or rubber base that rests on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.

C. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

D. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

E. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's written instructions.

B. Provide pipe supports as required and as detailed on the drawings.

C. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.

D. Install supports to provide indicated pipe slopes and not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

E. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Contractor must coordinate pipe weights with the structural design consultant for all pipe sizes prior to supporting from wood structures.

I. Provide roof mounted supports for all roof mounted pipe. Secure bottom of support flat on roof deck. Account for roof slope to provide level mounting service for equipment. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counterflashing by the General Contractor.

J. Hanger and Support Spacing

1. Provide a hanger within 24 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
2. Where several pipes can be installed at the same elevation in parallel, provide multiple or trapeze hangers.
3. Support riser piping independently of connected horizontal piping.
4. Space hangers for pipe as follows unless stated differently within each pipe system specification section:

Pipe Material	Pipe Size	Max Spacing Horizontal	Max Spacing Vertical
Thermoplastic	1/2" through 1"	3'-0"	5’-0”
Thermoplastic	1-1/4" and over	4'-0"	5'-0"

5. Support vertical runs of PVC plastic pipes per manufacture's written instructions, requirements of authorities having jurisdictions or when not defined, at the roof, at each floor, and at 5-foot intervals between floors.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment nameplates.

B. Adhesive-backed duct markers.

C. Pipe markers.

D. Ceiling labels.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates and ceiling labels where located above ceilings.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Dampers: Tags and ceiling labels where located above lay-in ceiling.

E. Ductwork: Adhesive backed duct markers.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Pipe markers.

I. Relays: Tags.

J. All Other Division 23 Equipment not listed above: Nameplates and ceiling labels where located above ceilings.

2.02 EQUIPMENT NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1 inch.

C. Background Color: Black.

D. Thickness: 1/8 thick, predrilled holes.

E. Label Content: Equipment drawing designation or unique number.

F. Adhesive: Permanent type compatible with label and substrate.

G. Material: Plastic, comply with ASTM D709.

H. Fastener: Stainless steel screws or rivets

2.03 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks; minimum information indicating flow direction arrow and system identification.

B. Style: Individual Label.

C. Letter Height: Minimum of 1-1/2 inch.

2.04 PIPE MARKERS

A. Plastic Pipe Markers: Factory fabricated, color-coded, with lettering indicating service, and showing flow direction, letter size at least 1-1/2” high.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Label Content: Identify piping service using the same designation as on the documents with arrow showing flow direction.

2.05 CEILING LABELS

A. Description: Clear background label with black lettering, 1/2 inch in height. Clear acrylic adhesive backing. Adhesive shall be compatible with label and with substrate.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping.

C.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Locate ductwork and pipe identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure, enclosure, wall, and at each obstruction.

F. Install ductwork with plastic nameplates. Identify with air handling unit identification number. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling labels to identify devices (valves, control dampers, life safety dampers, air terminal units, and other equipment) installed above ceilings. Locate closest to device and where applicable, locate on grid not ceiling panel. Refer to Owner’s requirements for naming convention that may be differ from the described herein.

    1. When an access panel is located in a ceiling, locate ceiling label directly on the access panel.

H. Install labels on all Division 23 equipment. Labels to be easily accessible and visible.

3.03 SCHEDULE

A. Pipe Label and Color Schedule

1. Condensate Drain Piping:

a. Background Color: White.
b. Letter Color: Black.
c. Label drain termination with information on unit served.

B. Duct Label and Color Schedule

1. Install duct labels with permanent adhesive on all air ducts in the following color codes:

a. In coordination with Owners Standard or as follows:
b. Supply Air Ducts: White letters on Green background.
c. Return Air Ducts: White letters on Blue background.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING OF SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating conditions of installed systems.

C. Commissioning activities.

1.02 RELATED REQUIREMENTS

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

B. Section 012100 - Allowances: Inspection and testing allowances.

C. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.

D. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

E. Section 230800 - Commissioning of HVAC.

F. Section 233100 - HVAC Ducts.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024.

D. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit to the Commissioning Authority.
3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
5. Include the following in the plan:

    a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    c. Identification and types of measurement instruments to be used and their most recent calibration date.
    d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    e. Final test report forms to be used.
    f. Detailed step-by-step procedures for TAB work for each system and issue, including:

        1) Terminal flow calibration (for each terminal type).
        2) Diffuser proportioning.
        3) Branch/submain proportioning.
        4) Total flow calculations.
        5) Rechecking.
        6) Diversity issues.

    g. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
    h. Confirmation of understanding of the outside air ventilation criteria under all conditions.
    i. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
    j. Method of checking building static and exhaust fan and/or relief damper capacity.
    k. Proposed selection points for sound measurements and sound measurement methods.

l. Methods for making coil or other system plant capacity measurements, if specified.
m. Time schedule for TAB work to be done in phases (by floor, etc.).
n. Description of TAB work for areas to be built out later, if any.
o. Time schedule for deferred or seasonal TAB work
p. False loading of systems to complete TAB work, if specified.
q. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
r. Interstitial cavity differential pressure measurements and calculations, if specified.
s. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
t. Procedures for formal progress reports, including scope and frequency.
u. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to the Commissioning Authority and Construction Manager.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Submit all testing, adjusting and balancing reports bearing the seal and signature of the AABC or TABB Certified Test and Balance Supervisor.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit under provisions of Section 014000.
2. Submit to the Commissioning Authority and Construction Manager within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
5. Provide reports in Adobe Reader PDF form, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in I-P (inch-pound) units only.
9. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

I. Include approved TAB Reports in the Operation and Maintenance Manuals.

1.05 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. Adjust: To regulate fluid flow rates and air patterns at the system or terminal level. At the system level an example would be reducing fan speed; at the terminal level an example would be changing a damper position.

C. Balance: To proportion air or water flows within the distribution system, including submains, branches and terminals with respect to design quantities.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person’s skin than is normally dissipated.

E. Independent: Not affiliated with or in employment of any Contractor.

F. NEBB: National Environmental Balancing Bureau.

G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

L. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

M. TAB: Testing, adjusting, and balancing.

N. TAB Specialist: An entity engaged to perform TAB Work.

O. Testing, Adjusting and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.

1.06 WARRANTY

A. Provide one of the following performance guarantees:

1. AABC National Project Performance Guarantee.
2. TABB Quality Assurance Program Guarantee.

B. Guarantee shall include provisions that the certified TAB firm has tested and balanced systems according to the Contract Document and that the systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Provide total mechanical, plumbing, and fire suppression systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical, plumbing, and fire suppression equipment, all in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).

B. Begin work after installation of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Test, adjust and balance all air, , and fire suppression systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

E. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner's project representative.

F. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

G. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

H. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

I. Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

J. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

K. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

L. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

M. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the

duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

N. Contact the temperature control contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Assist the temperature control contractor in the implementation of applicable fan static and dynamic offset sequences. Include in report description of temperature control operation and any deficiencies found.

O. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

P. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

Q. Coordinate and assist commissioning agent with all verification activities including providing all required sampling necessary for the commissioning process.

R. Venturi air valves provided with electronic characterization curves that require adjustment shall be brought to the attention of the venturi air valve supplier and the project engineer who shall determine if there is an installation or product issue. If it is determined that the characterization curves need to be adjusted, the venturi valve supplier shall work with the balancing contractor to adjust the curves as needed to bring them into the tolerance listed above. Flow adjustments for these characterized venturi valves shall never be done in the DDC system which is receiving a linearized flow signal from the venturi air valve.

S. Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

T. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:

    a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

U. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by the Owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB, AABC, or TABB Standards.

C. Instrument test holes to be Ventlock #699.

3.03 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Water systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.04 PREPARATION

A. Hold a pre-balancing meeting prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer/ Owner to facilitate spot checks during testing if desired.

C. Provide additional balancing devices as required.

3.05 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.06 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. Verify and record, in the report, “K” factors for all VAV air terminal devices and air flow stations.

F. After calibration and the “K” factors are programmed into the DDC controller, verify and record, in the report, the BAS VAV air terminal devices and air flow stations flow readings as the final test result.

G. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

H. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

I. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and, if desired, witnessed by the Owner.

3.07 AIR SYSTEM PROCEDURE

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

H. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

I. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

J. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

K. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

L. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

M. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

N. Inspect ceiling ms intended for supply, return, or relief air to ensure they adhere to the leakage class outlined in Section 233100 HVAC Ducts and Casings and are adequately isolated from adjacent spaces. Additionally, confirm that any penetrations in plenum walls are appropriately sealed and, if necessary, fire-stopped.

3.08 AIR SYSTEM PRESSURIZATION

A. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by design air quantities or pressure relationship diagrams/ drawings, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship. Refer to drawings for additional documentation.

B. For rooms scheduled in air terminal schedule to maintain a positive pressure, the supply terminals shall be balanced to the tolerance listed above and the general exhaust terminal(s) shall be balanced to the flow required to maintain the room pressurization design offset CFM within the tolerance listed above.

1. Example:

    a. Design Total Exhaust Flow = 2800 CFM
    b. Design Total Supply Flow = 3000 CFM
    c. Design Offset Flow = +200 CFM
    d. Balanced Supply Flow = 3000 CFM (+10% of design)
    e. Balanced Exhaust Flow = 2520 CFM (-10% of design) – The exhaust would need to have its K factor adjusted to increase flow to between 3060 CFM and 3140 CFM to be within 20% of the design room offset (160 to 240 CFM).

C. When balancing is complete, this contractor shall measure the overall building pressure at the exterior egress doorways of the building and include this in the balancing report.

3.09 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 100% percent of the air handling equipment.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:

    a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    c. Temperatures: Deviation of more than one degree F.
    d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods,

established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

G. No seasonal tests are required.

H. No further monitoring is required.

I. No deferred testing is required.

3.10 SCOPE

A. Test, adjust, and balance the following:

1. Outdoor/ Roof Mounted Air Handling Units.
2. Air Inlets and Outlets.

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

C. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

D. Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.
12. Motor Voltage Amperage, Service Factor,
13. Make, Size, and Number of Belts

E. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

F. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.

3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:

    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.

7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

G. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

H. Sound Level Reports:

1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

3.12 DEFICIENCIES

A. Division 23 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner/ Engineer of Record of these items and instructions will be issued to the Division 23 contractor for correction of the deficient work. All corrective work to be done at no cost to the project. Retest systems, equipment, and devices once corrective work is complete as specified.

3.13 INSPECTIONS

A. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

B. Recheck the following for each system:

1. Measure airflow of at least 10 percent of air outlets.
2. Measure water flow of at least 5 percent of terminals.
3. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
4. Verify that balancing devices are marked with final balance position.
5. Note deviations from the Contract Documents in the final report.

3.14 FINAL TAB REPORT VERIFICATION

A. The Engineer, Owner, or Commissioning Authority will select for recheck measurements from the final report, covering the lesser of 10% of total measurements or what can be completed in an 8-hour workday.

B. Measurements exceeding allowable tolerances will be marked as "FAILED."

C. If over 20% of rechecked measurements fail, the original TAB process will be deemed incomplete, requiring the TAB contractor to recheck and rebalance all original measurements at no additional cost to the Owner or design team.

3.15 ADDITIONAL TESTS

A. Seasonal Periods: If initial T&B procedures were not conducted under near-peak conditions, the engineer of record or Owner may request a rechecks to verify performance.

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 099113 - Exterior Painting: Painting insulation jackets.

D. Section 099123 - Interior Painting: Painting insulation jackets.

E. Section 230553 - Identification for HVAC Piping and Equipment.

F. Section 233100 - HVAC Ducts.

1.03 REFERENCE STANDARDS

A. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems, Current Edition, Including All Renovations.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. 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).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

G. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

H. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

J. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

K. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

L. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

M. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016 (Reapproved 2021).

N. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

O. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

P. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2017 (Reapproved 2023).

Q. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

R. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

S. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

T. ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester; 2020.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

V. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

W. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

X. FM 4924 – Examination Standard for Pipe and Duct Insulation; 2024.

Y. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

Z. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

AA. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

BB. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

CC. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

DD. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

D. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. CertainTeed Corporation; SoftTouch Duct Wrap
2. Johns Manville; Microlite.
3. Knauf Insulation; Friendly Feel Duct Wrap.
4. Owens Corning Corporation; SOFTR All Service Duct Wrap.

B. Insulation: ASTM C553; flexible, noncombustible blanket, formaldehyde-free, bonded mineral or glass fibers.

1. K value: 0.26 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper or polypropylene encapsulated paper backing in compliance with ASTM C 1136, Type II. For bonding insulation jacket lap joints and seams comply with MIL-A-3316C, Class 2, Grade A.

1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
2. Secure with pressure-sensitive tape.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Manufacturers:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW

2. FSK Tape: ASTM C 1136 Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive.

E. Glass Fiber Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with MIL-A-3316C, Class 2, Grade A.

2.03 GLASS FIBER, RIGID BOARD

A. Manufacturer:

1. CertainTeed Corporation; Commercial Board
2. Johns Manville; 800 Series Spin Glass
3. Knauf Insulation; Insulation Board
4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation

B. Insulation: ASTM C612; rigid, noncombustible board of bonded mineral or glass fibers.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 1.5 pcf

C. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper or polypropylene encapsulated paper backing in compliance with ASTM C 1136, Type II.

1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
2. Secure with pressure-sensitive tape.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Manufacturers:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW

2. FSK Tape: ASTM C 1136 Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive. 3 inch width, 5.5 mils thick, elongation 2%, adhesion 90 ounces force/inch in width, tensile strength 39 lbf/inch in width.

E. Glass Fiber Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with MIL-A-3316C, Class 2, Grade A.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. All coverings and linings, including adhesives when used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E84 or UL 723.

B. Install in accordance with manufacturer's written instructions.

C. Install in accordance with NAIMA National Insulation Standards.

D. Install a continuous, unbroken vapor barrier for ducts and plenums with surface temperatures below the ambient dew point.

E. Provide insulation with vapor barrier jackets.

F. Continue insulation with vapor barrier through non rated walls, partitions, non rated floors, roofs, sleeves, hangers, and other duct penetrations.

G. Insulate entire system, including fittings, joints, flanges, dampers, life safety dampers, flexible connections, and expansion joints.

H. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

I. Secure flexible blanket duct insulation on sides and bottom of ductwork over 24" wide with weld pins. Space fasteners 18” on center or less as required to prevent sagging. Compress insulation no more than 25%.

J. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted together and placed as close as possible to the equipment surface. Pins shall be located a maximum of 3” from each edge and spaced no greater than 12” on center.

K. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4” tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed with vapor retarding mastic.

L. Where insulation is penetrated by supports, hangers, flanges, stiffeners, etc., add additional insulation to cover penetrated insulation by six inches in every direction. Additional insulation shall be the same material and thickness as the insulation being penetrated.

1. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation and to provide a complete vapor barrier.
2. Where insulated ductwork is supported by steel metal straps or wire ropes/ cables that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.
3. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor retarding jacketing to encapsulate the support channels.

M. In areas requiring fire-rated insulation systems, ensure the system is securely fastened to ducts, hangers, and supports to uphold a consistent fire rating. Insulate duct access panels and doors to match the fire rating of the duct. Implement firestopping at points where penetrations occur through fire-rated structures. Fire-stop systems are detailed in Division 7 specifications.

N. Provide flexible removable and reusable blanket insulation where duct access is necessary.

O. External Duct Insulation Application:

1. Secure insulation with vapor barrier and seal jacket joints with vapor barrier adhesive or vapor barrier tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
5. Install multiple layers of insulation with end and longitudinal seams staggered.
6. Align longitudinal seams of insulation at top and bottom of horizontal ductwork runs.
7. Do not compress insulation more than 75% of its listed nominal thickness.
8. Repair damaged insulation.

P. Existing materials designated to remain, which are damaged or defaced as a result of the work shall be replaced at Contractor's expense to like new condition. Restore damaged insulation by using the same insulation as the damaged sections. New insulation to extend beyond the damaged area by at least 4 inches.

Q. Field painting of insulation located within a plenum is prohibited as painting of insulation will void original ASTM E84 smoke and flame ratings of the insulation.

R. Insulating contractor shall allow the engineer to select components to be inspected to ensure conformity with this section. One duct, fitting and accessory shall be selected for inspection for each type of duct system. Inspection shall be done by cutting into installed insulation/jacket/vapor barrier in a manner that will allow for review of each layer. Additional testing shall be required if original inspection finds that insulation installation does not comply with this specification section.

3.03 DUCT AND PLENUM INSULATION SCHEDULE - INDOOR

A. Supply Air Ducts:

1. General: Insulate supply air ductwork, including existing supply ducts not currently insulated, as indicated below and provide a complete vapor barrier.

2. Concealed Locations (i.e. above ceiling, in chases, etc.):

a. Round and Oval: 1-1/2” thickness, 0.75 pcf, mineral-fiber blanket with FSK facing.
b. Rectangular: 1-1/2” thickness, 3.0 pcf mineral fiber board with FSK facing or 1-1/2” thickness, 0.75 pcf, mineral-fiber blanket with FSK facing.

B. Return Air Ducts:

1. General: Insulate return air ductwork, including existing supply ducts not currently insulated, as indicated below.
2. Concealed Locations:

a. Rectangular: 2” thickness, 3.0 pcf, glass fiber board with FSK facing.
b. Round and Oval: 2” thickness, 1.5 pcf, glass fiber blanket with FSK facing.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Ductwork and accessories.
4. Variable frequency drives.
5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

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

B. Section 015719 - Temporary Environmental Controls: Precautions and procedures; smoking room testing; building flush-out.

C. Section 017800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

D. Section 017900 - Demonstration and Training: Scope and procedures for Owner personnel training.

E. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

F. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

G. Section 230913 - Instrumentation and Control Devices for HVAC.

H. Section 230923 - Direct-Digital Control System for HVAC.

I. Section 230993 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.
2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:

    a. Process of verifying proper hardware and wiring installation.
    b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
    c. Process of performing operational checks of each controlled component.
    d. Plan and process for calibrating valve and damper actuators and all sensors.
    e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:

    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:

    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.

f. Sensors.
g. Dampers and damper actuators.
h. Program setups (software program printouts).

E. Project Record Documents: See Section 017800 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 017900, include:

1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 017900 for additional requirements.

1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

1.05 CONTRACTOR’S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.06 CX’S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.07 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

B. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.

1. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
2. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
3. Test and inspection reports and certificates.
4. Corrective action documents.
5. Verification of testing, adjusting, and balancing report

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. 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.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 TEST AND BALANCE VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 5 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 5 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.05 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 20 percentmore points than specified at no extra cost to Owner.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. “After hours” use tracking and billing.
14. Communications to remote sites.
15. Fire alarm interlocks and response.
16. Fire protection and suppression systems interfaces.
17. Security system interlocks.
18. That points that are monitored only, having no control function, are reporting properly to the control system.
19. All control strategies and sequences not tested during controlled equipment testing.
20. Trend logging and graphing features that are specified.
21. Other integrated tests specified in Contract Documents
22. That control system features that are included but not specified to be setup are actually installed.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.06 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 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.

3.07 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide at a minimum, training of the following systems:

1. HVAC Control System.
2. Variable Speed (Frequency) Drives.
3. Packaged Rooftop Units.

E. TAB Review: Instruct Owner's personnel, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

    a. This training may be held on-site or at the manufacturer's facility.
    b. If held off-site, the training may occur prior to final completion of the system installation.
    c. For off-site training, Contractor shall pay expenses of up to two attendees.

2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:

    a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
    b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
    c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
    d. Every display screen, allowing time for questions.
    e. Setting up and changing an air terminal unit controller.
    f. Graphics generation.
    g. Point database entry and modifications.
    h. Understanding DDC field panel operating programming, when applicable.

3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

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SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Dampers.

C. Damper Operators:

1. Electric operators.

D. Wall-, Surface-, and Duct-Mounted Sensors:

1. Temperature sensors.
2. Humidity sensors.
3. Damper position indicators.

1.02 RELATED REQUIREMENTS

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

B. Section 233300 - Air Duct Accessories.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

D. Section 262726 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

C. ANSI C12.10 - American National Standard for Physical Aspects of Watthour Meters - Safety Standard; 2011 (Reaffirmed 2021).

D. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.

E. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

F. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).

G. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

H. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

I. ASTM B32 - Standard Specification for Solder Metal; 2020.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

L. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems; 2019.

M. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics; 2021.

N. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2020.

O. AWWA C707 - Encoder-Type Remote-Registration Systems for Cold-Water Meters; 2022.

P. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

Q. FieldComm Group (FFTS) - Foundation Fieldbus Technical Specifications; 2014.

R. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

S. IEEE 802.3 - IEEE Standard for Ethernet; 2022, with Amendment (2024).

T. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).

U. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).

V. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

W. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

X. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

Y. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; 2013.

Z. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AA. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

BB. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

CC. NSF 372 - Drinking Water System Components - Lead Content; 2022.

DD. ODVA (CIP) - The Common Industrial Protocol (CIP) Standards: EtherNet/IP, DeviceNet, ControlNet, and CompoNet; Current Edition.

EE. ProfiBus/ProfiNet SSG - ProfiBus, ProfiNet, and IO-Link Specifications, Standards and Guidelines; Current Edition.

FF. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

GG. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

HH. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

E. Project Record Documents: Record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Substantial Completion.

1.07 EXTRE MATERIALS

A. Provide 2 sets of actuators for each motorized damper.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Provide necessary analog and digital sensors and transmitters to fulfill the building automation system's functional requirements as indicated in the control diagrams, input/output summaries, sequences of operations, or the sequences of operations minimum points list.

C. Ensure input/output sensors and devices match the remote panel requirements to deliver accurate, responsive, and noise-free input/output signals. The control input response should exhibit high sensitivity and be aligned with the loop gain requirements for precise and responsive control. Provide a transmitter if the control system requires it.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

2.03 INSULATED CONTROL DAMPERS

A. Manufacturers:

1. TAMCO Inc, (9000-SC).
2. Ruskin (TED-50).
3. Johnson Controls.

B. Airfoil Low-Leakage Construction: Rectangular, aluminum damper with insulated blades and frame.

1. Function: Control of air streams in low, medium, and high velocity systems where thermal isolation is desired when damper blades are closed.

C. Application Limits:

1. Air Stream Velocity: 4000 FPM
2. Pressure Differential: 8” w.g. (variable with blade length)
3. Temperature: -40°C to 100°C.

D. Performance Characteristics: For a standard 48”x48” test section.

1. Maximum Air Leakage: Tested in conformance with AMCA 500 using Test Setup Apparatus Fig. 5.5 with an applied holding torque of 5.2 in.-lb./sq. ft.

   a. AMCA Certified Performance: 4.1 cfm/sq. ft. at 4” w.g. differential pressure when tested between 50° and 104°F.
   b. Cold Temperature Performance: 5.8 cfm/sq. ft. at 4” w.g. differential pressure when tested at -20°F.

2. Air Pressure Drop: 0.03” w.g. maximum at 1000 fpm face velocity.

E. Construction: Mill finish.

1. Frame: 4” x 1” extruded 6063T5 aluminum channel sections formed with integral stiffeners, reinforced corner radii, edge returns, screw retainer strips, and recesses and flanges for blade jamb and edge seals.

   a. Minimum Extrusion Thickness: 0.08”.
   b. Insulation: Extruded polystyrene board filling open space in frame channels.

2. Blades: 6” maximum width, thermally-broken, internally insulated with high-density polyurethane CFC free foam, 6063T5 extruded aluminum with hexagonal axleway, airfoil shape with integral full-length reinforcing tube.

   a. Insulation: Non-CFC, water blown, expanded polyurethane foam. Intrinsic to blade extrusion, and shielded from air stream.
   b. Insulating Factor: R-2.29.

c. Temperature Index: 55.

3. Blade Axles: 7/16” hard alloy aluminum.
4. Blade Linkages: Exposed and out of stream. Non-slip design using flat-on-flat press-fit components to mate with hexagonal surfaces.

   a. Linkage Hardware: Installed in frame side and constructed of aluminum and corrosion resistant, zinc and nickel plated steel, complete with cup-point trunnion screws.
   b. Crank arm & Linkage Rods: Hexagonal, hard alloy 6005T5 aluminum

5. Bearings: Celcon inner bearing fixed to blade axle and rotating within polycarbonate outer bearing inserted in damper frame.
6. Drive Rod: 12” minimum length, zinc plated steel, extendible single rod designed to provide positive blade rotation without binding.
7. Blade Edge and Jamb Seals: Silicone material formulated to maintain flexibility and resist dynamic fatigue for sealing longevity and resistance to weathering, compression set, and heat.

2.04 DAMPER OPERATORS

A. Manufacturers:

1. Belimo Aircontrols (USA), Inc
2. Control system provider’s standard, subject to compliance.

B. General:

1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. Type: Electronic direct-coupled designed by application on HVAC dampers.
6. Actuator Motors: Brushless DC motor controlled by an application specific integrated circuit and a microprocessor providing constant rotation rate and exact zero position.
7. Actuator Overload Protection: Electronic overload or digital rotation sensing circuitry.

   a. Power supply: Nominal 24 VDC or less.
   b. Electric Motors: Sized to operate with sufficient reserve power to provide smooth modulating action or two-position action against system duct static pressure and damper size. Sizing of actuators is the responsibility of this contractor.

8. Actuator Coupling: Direct clamp assembly attachment over damper drive shaft or jack shaft.
9. Power-Failure/Safety Return Actuators: Equipped with internal mechanical spring return mechanism.

    a. Manual Crank: Provided on actuators with more than 60 in-lb torque capacity to permit manual positioning of damper when actuator is not powered.

10. Non-Spring Return Actuators: Equipped with external manual gear release to allow manual positioning of damper when actuator is not powered.
11. Proportional Action Input Control Signals: 0 to 10 VCD with 2 to 10 VDC range, or 0 to 20 mA with 4 to 20 mA range, or pulse width modulating.
12. Minimum Design Life: 60,000 full stroke cycles.
13. Actuator Housing: Double insulated, zinc-coated metal or UL 94V-0 rated

    a. Standard Applications: NEMA type 2.
    b. Special Applications: NEMA 4X, explosion-proof, or weather proof as appropriate for environment.

14. Angle of Rotation: Mechanically limited to 95°.
15. Electrical Connection: 3 foot long cable with conduit connector.
16. Maximum Noise Level: 45 dBA.

2.05 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS

A. Temperature Sensors:

1. Use RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
4. Temperature Sensing Device: Compatible with project DDC controllers.
5. Insulating Bases: For temperature sensors located on exterior walls.
6. Performance Characteristics:

    a. RTD:

        1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
        2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
        3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
        4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
        5) Range: Minus 40 degrees F through 220 degrees F minimum.

    b. Temperature Transmitter:

        1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.

2) Output: 4 to 20 mA.

c. Sensing Range:

1) Provide extended range sensors if required to sense the range expected for a respective point.
2) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.

d. Wire Resistance:

1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.

e. Room Sensors: Locking cover
f. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
g. Ceiling and Recessed Mount Temperature Sensors: Ceiling-mounted sensor in a low-profile housing.
h. Room Security Sensors: Stainless steel cover plate with insulated back and security screws.
i. Room Temperature Sensors:

1) Construct for wall box mounting, insulated back, stainless steel cover plate.

j. Room Temperature Sensors with Integral Digital Display:

1) Construct for wall box, insulated back.
2) Provide a four button keypad with the following capabilities:

(a) Indication of space temperature.
(b) Setpoint adjustment to accommodate room setpoint.
(c) Display and control fan operation status.
(d) Manual occupancy override and indication of occupancy status.
(e) Controller mode status.
(f) Password enabled setpoint and override modes.

k. Temperature Averaging Elements:

1) Use on duct sensors for ductwork 10 sq ft or larger.
2) Use averaging elements where prone to stratification with sensor length 8 ft or 16 ft.
3) Provide for all mixed air, heating coil, and cooling coil discharge sensors regardless of duct size or air handling unit size.

l. Insertion Elements:

1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.

B. Humidity Transmitters, Surface-Mounted:

1. Manufacturers:

a. Vaisala HMW80 series
b. Johnson Controls International, PLC

2. High impact ABS plastic housing encased, wall-mounted, humidity indicating sensor.
3. Humidity Sensor Type: Replaceable thin-film capacitive.
4. Accuracy: Plus/minus 2 percent between 10 to 80 percent RH linear range, NIST traceable with multi-point calibration.
5. Output: Two-wire, 4 to 20 mA, 0 to 5 VDC or 0 to 10 VDC, non-loop powered, selectable.
6. Temperature Sensor, Combined: Platinum RTD.

a. Transmitter: Fitted within device-interface enclosure, calibrated.
b. Monitoring Range: 32 to 122 degrees F, adjustable.
c. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
d. Accuracy: Plus/minus three percent. adjustable on the transmitter end.

C. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.

2.06 RACEWAYS AND FITTINGS

A. Raceway Systems: Continuous from outlet to outlet, including pulling and junction outlets, bushings, couplings, and other fittings.

B. Products: As specified in Division 26.

2.07 WIRES AND CABLES

A. Products: As specified in Division 26 and Division 27.

B. Insulation:

1. 600 Volt class, except low voltage wiring may be 300 Volt class if isolated from line voltage wiring.
2. All wire and cable not in conduit shall be plenum rated and color coded per NFPA 70 with self-adhesive wrap.

C. Color Coding:

1. Line Voltage and or Low Voltage Wiring: By line or phase in compliance with NFPA 70.

2. Prohibited Codings: Use of white, white with colored stripe, gray, green and green with colored stripe to indicate other than neutral and grounding conductors.

D. Wire Markers:

1. Line Voltage: Full wrap self-adhesive type.
2. Low Voltage: Include full wrap self-adhesive type labels on each cable end and on each terminated and un-terminated conductor.

2.08 RELAYS AND CONTACTORS

A. Relays: General purpose, latching, and time delay types, rated for application.

1. Contacts:

a. Type: Silver-cadmium. Form C.
b. Enclosure: Dustproof.
c. Life Span: One million operations.

2. Operating Time: 20 milliseconds or less.
3. Release Time: 10 milliseconds or less.

B. Current Sensing Relays:

1. Output Characteristic: SPST solid state, normally open (DC only).
2. Output Rating: 60 MA, 24 Vdc minimum.
3. Trip Point: Adjustable.

C. Contactors: Single coil, electrically operated, mechanically held type, rated for application.

1. Contacts:

a. Type: Double break, silver to silver, protected by arcing contacts.
b. Operating and Release Times: 100 milliseconds or less.
c. Positive Locking: Without use of hooks, latches, and semi-permanent magnets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 FURNISH FOR INSTALLATION BY OTHERS

A. Furnish control dampers to the sheet metal contractor for installation.

B. Furnish air flow measuring stations to the sheet metal contractor for installation.

C. Furnish control valves to the plumbing/ piping contractor for installation.

D. Furnish hydronic and steam sensors and wells to the plumbing/ piping contractor for installation.

E. Furnish hydronic and steam meters to the plumbing/ piping contractor for installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Provide access panels for any instrumentation or control device above inaccessible ceilings or walls.

C. Install pressure reducing stations consisting of pressure reducing valve, strainer, valve bypass, pressure gauge on inlet and outlet, and pressure relief valve.

D. Install air pressure switches and transmitters associated with individual air handling units or equipment in ductwork located immediately adjacent to the air handling unit or equipment. Location of switches and transmitters shall be easily accessible with setpoint, alarm, trending, and graphics on the BAS.

E. Ductwork and plenum penetrations shall be sealed in accordance with the specified duct static pressure and leakage and seal classes, using grommets or neoprene gaskets.

F. Sensor Location:

1. Verify location of thermostats, controllers, humidistats and other exposed control sensors with plans, the Owner, and room details before installation. Locate adjustable thermostats, controllers, and humidistats 48 inches above the floor. All manual adjusting thermostats, controllers, humidistats and other exposed control sensors within ADA compliant areas must meet ADA installation guidelines for forward reaching approach. Nonadjustable thermostats, sensors, and humidistats may be mounted at 60 inches above the floor within non ADA areas such as but not limited to electrical, IT, MPOP, and mechanical rooms. Locate carbon monoxide, carbon dioxide, nitrogen and all other gas sensors and gas detectors per manufacturer's installation requirements.

    a. Provide insulated sub-bases on temperature sensors, controllers, thermostats, humidistats required to be installed on exterior walls or exterior columns. Seal wall penetration for wiring with silicone caulk.

2. Mount freeze protection thermostats using flanges and element holders.
3. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
4. Install averaging elements in plenums and ducts in zigzag or serpentine crossing pattern.
5. Provide separable sockets for liquids and flanges for air bulb elements.
6. Provide thermostats in locking aspirating boxes in public spaces, building entrances, gymnasiums, high security areas, and where indicated.

G. Damper Installation:

1. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor.
2. Provide isolation (two-position) dampers of parallel blade construction.
3. Provide and install insulated low leakage control dampers for outside air and exhaust/relief dampers. Provide and install non-insulated low leakage control dampers in the return air systems.
4. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

H. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in the same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

I. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

J. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

K. Ship VAV air terminal controllers to VAV air terminal manufacturer for factory mounting on air terminal unit.

L. Calibrate installed instrumentation and control devices that are not factory calibrated.

M. Install refrigerant detection sensors and refrigerant mitigation controllers when not provided by the equipment manufacturer utilizing A2L refrigerants or other refrigerants requiring refrigerant monitoring per local codes, latest edition of ASHRAE 15, latest addition of ASHRAE 34, and the authority having jurisdiction.

3.04 ELECTRICAL WIRING AND CONNECTIONS INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway. Wire and cable of this section shall be in conduit within exposed mechanical spaces.
3. Install concealed cable in raceway. Wire and cable of this section shall be required to be in cable tray or some other approved cable management system when above finished ceiling, exposed in public spaces, or within finished walls.
4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code and color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
8. No spliced wiring is acceptable.
9. Control components shall not be installed in UL listed and approved assemblies unless the equipment is specifically listed to include that equipment. Provide a separate enclosure for control devices.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.05 IDENTIFICATION

A. Label all system components, control cabinets, control panels, wiring, cables, and terminals. Use identical designations at both ends of each wire, cable, and tubing to enable operators to verify continuity at connection points. Refer to Division 26 specifications for additional information.

B. Install nameplate with valve identification at valve and on face of ceiling directly below valves concealed above ceilings. Refer to specification section 230553.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800-Closeout Submittals for closeout submittals.

B. See Section 017900-Demonstration and Training for additional requirements.

C. Train operating personnel in operation and maintenance of units.

D. Provide the services of manufacturer's field representative to conduct training.

1. Demonstrate operation of all safety controls.
2. Train operating personnel in operation of units.
3. Demonstrate operation of the boilers over the entire firing range of the burners.

3.07 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Train operating personnel in operation and maintenance of units.

C. Provide service and maintenance of control system for one year from Date of Substantial Completion.

D. Provide complete service of controls systems, including call backs, and submit written report of each service call.

END OF SECTION

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

1.02 RELATED REQUIREMENTS

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

B. Section 230913 - Instrumentation and Control Devices for HVAC.

C. Section 230993 - Sequence of Operations for HVAC Controls.

D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

E. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).

B. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems; 2019, with Addendum (2024).

C. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

D. CTA-709.1 - Control Network Protocol Specification; 2019.

E. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--

Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).

F. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).

G. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

H. LonMark SCPT List - LonMark SCPT Master List; Version 15; 2014.

I. LonMark SNVT List - LonMark SNVT Master List; Version 15; 2014.

J. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2022h, with Editorial Revision.

K. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide data for each system component and software module.

D. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. List connected data points, including connected control unit and input device.
3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
5. Indicate description and sequence of operation of operating, user, and application software.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Designer Qualifications: Perform design of system using manufacturer's software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.07 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tridium Niagara.

2.02 SYSTEM DESCRIPTION - MODIFICAITONS/ ADDITION TO AN EXISTING BUILDING AUTOMATION SYSTEM

A. Work consists of furnishing, installing, testing and commissioning the modification of the existing Alerton and/or Niagara building automation system (BAS). All new controls components shall fully interface and integrate with existing BAS.

B. At the conclusion of this project, the Building Automation System shall be a fully integrated collection of network level controllers, modular input/output devices, application specific controllers, configuration, programming and web server software, all designed, manufactured and supplied by the existing building automation system manufacturer to work together as a complete system; fully integrating new and existing components.

C. Modify and or provide new computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators to allow seamless integration with the existing building automation system.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 SYSTEM DESCRIPTION

A. Work consists of furnishing, installing, testing and commissioning an automatic temperature control field monitoring and control system using field programmable micro-processor based units with communication to a building automation system (BAS).

B. The Building Automation System shall be a fully integrated collection of network level controllers, modular input/output devices, application specific controllers, configuration, programming and web server software, all designed, manufactured and supplied by one manufacturer to work together as a complete system.

C. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

D. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

E. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

F. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

G. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

H. System shall utilize Native BACnet Devices throughout.

2.04 OPERATOR INTERFACE

A. Controllers, and control backbone to communicate using BACnet protocol and addressing.

B. BACnet protocol to comply with ASHRAE Std 135.

2.05 CONTROLLERS

A. Building Controllers:

1. General:

a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
c. Share data between networked controllers.
d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
e. Utilize real-time clock for scheduling.
f. Continuously check processor status and memory circuits for abnormal operation.
g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
h. Communication with other network devices to be based on assigned protocol.

2. Communication:

    a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
    b. Perform routing when connected to a network of custom application and application specific controllers.
    c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. External Input-Output (I-O) Data Bus:

    a. Input only modules.
    b. Output only modules.
    c. Variable frequency drives (VFD's).
    d. Universal I-O module (configurable).
    e. Access control module for single door.
    f. Specific wired and wireless data integration modules.
    g. DALI (Digital addressable lighting interface) modules.
    h. Motor control of devices like blinds, roller shutters, and sun protection systems.
    i. Multiple Input Output (I-O) Module:

        1) IAQ: Temperature, humidity, and CO2.
        2) Audio: Microphone, tone generator, and speaker.
        3) Input and output terminals to monitor or control local devices.
        4) Occupancy: Light and thermal sensing with multi-colored LED feedback.

4. Anticipated Environmental Ambient Conditions:

    a. Outdoors and/or in Wet Ambient Conditions:

        1) Mount within waterproof enclosures.
        2) Rated for operation at 40 to 150 degrees F.

    b. Conditioned Space:

        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.

5. Provisions for Serviceability:

    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
7. Power and Noise Immunity:

a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:

1. General:

a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
b. Share data between networked, microprocessor based controllers.
c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
d. Utilize real-time clock for scheduling.
e. Continuously check processor status and memory circuits for abnormal operation.
f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
g. Communication with other network devices to be based on assigned protocol.

2. Communication:

a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

a. Outdoors and/or in Wet Ambient Conditions:

1) Mount within waterproof enclosures.
2) Rated for operation at 40 to 150 degrees F.

b. Conditioned Space:

1) Mount within dustproof enclosures.
2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:

a. Diagnostic LED's for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:

    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:

1. General:

    a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
    b. Customized for operation within the confines of equipment served.
    c. Communication with other network devices to be based on assigned protocol.

2. Communication:

    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

    a. Outdoors and/or in Wet Ambient Conditions:

        1) Mount within waterproof enclosures.
        2) Rated for operation at 40 to 150 degrees F.

    b. Conditioned Space:

        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:

    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:

    a. Maintain operation at 90 to 110 percent of nominal voltage rating.

b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:

   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

3. Binary Inputs:

   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:

   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.

6. Binary Outputs:

   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

7. Analog Outputs:

   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:

a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

1) VAV terminal units.
2) Duct mounted heating coils.
3) Zone dampers.
4) Radiation.

c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:

a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.06 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:

    a. Dielectric strength of 1000 volts minimum.
    b. Response time of 10 nanoseconds or less.
    c. Transverse mode noise attenuation of 65 dB or greater.
    d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.07 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.08 SYSTEM SOFTWARE

A. Operating System:

1. Concurrent, multi-tasking capability.

    a. Common Software Applications Supported: Microsoft Excel.

2. System Graphics:

    a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
    b. Animation displayed by shifting image files based on object status.
    c. Provide method for operator with password to perform the following:

        1) Move between, change size, and change location of graphic displays.
        2) Modify on-line.

3) Add, delete, or change dynamic objects consisting of:

(a) Analog and binary values.
(b) Dynamic text.
(c) Static text.
(d) Animation files.

3. Custom Graphics Generation Package:

a. Create, modify, and save graphic files and visio format graphics in PCX formats.
b. HTML graphics to support web browser compatible formats.
c. Convert graphics from the bidding documents when not present in control vendor standard HVAC graphics library.

4. Standard HVAC Graphics Library:

a. HVAC Equipment:

1) .Rooftop units.

B. Generator.Workstation System Applications:

1. Automatic System Database Save and Restore Functions:

a. Current database copy of each Building Controller is automatically stored on hard disk.
b. Automatic update occurs upon change in any system panel.
c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.

2. Manual System Database Save and Restore Functions by Operator with Password Clearance:

a. Save database from any system panel.
b. Clear a panel database.
c. Initiate a download of a specified database to any system panel.

3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:

a. Context-sensitive system assists operator in operation and editing.
b. Available for all applications.
c. Relevant screen data provided for particular screen display.
d. Additional help available via hypertext.

5. Security:

    a. Operator log-on requires user name and password to view, edit, add, or delete data.
    b. System security selectable for each operator.
    c. System supervisor sets passwords and security levels for all other operators.
    d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
    e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
    f. All system security data stored in encrypted format.

6. System Diagnostics:

    a. Operations Automatically Monitored:

        1) Workstations.
        2) Printers.
        3) Network connections.
        4) Building management panels.
        5) Controllers.

    b. Device failure is annunciated to the operator.

7. Alarm Processing:

    a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
    b. Configurable Objects:

        1) Alarm limits.
        2) Alarm limit differentials.
        3) States.
        4) Reactions for each object.

8. Alarm Messages:

    a. Descriptor: English language.
    b. Recognizable Features:

        1) Source.
        2) Location.
        3) Nature.

9. Configurable Alarm Reactions by Workstation and Time of Day:

    a. Logging.
    b. Printing.

c. Starting programs.
d. Displaying messages.
e. Dialing out to remote locations.
f. Paging.
g. Providing audible annunciation.
h. Displaying specific system graphics.

10. Custom Trend Logs:

    a. Definable for any data object in the system including interval, start time, and stop time.
    b. Trend Data:

        1) Sampled and stored on the building controller panel.
        2) Retrievable for use in reports, spreadsheets and standard database programs.
        3) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
        4) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.

11. Alarm and Event Log:

    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.
    c. Operator with proper security acknowledges and clears alarms.
    d. Alarms not cleared by operator are archived to the workstation hard disk.

12. Object, Property Status and Control:

    a. Provide a method to view, edit if applicable, the status of any object and property in the system.
    b. Status Available by the Following Methods:

        1) Menu.
        2) Graphics.
        3) Custom Programs.

13. Reports and Logs:

    a. Reporting Package:

        1) Allows operator to select, modify, or create reports.
        2) Definable as to data content, format, interval, and date.
        3) Archivable to hard disk.

    b. Real-time logs available by type or status such as alarm, lockout, normal, etc.

c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
d. Set to be printed on operator command or specific time(s).

14. Reports:

a. Standard:

1) Objects with current values.
2) Current alarms not locked out.
3) Disabled and overridden objects, points and SNVTs.
4) Objects in manual or automatic alarm lockout.
5) Objects in alarm lockout currently in alarm.
6) Logs:

(a) Alarm History.
(b) System messages.
(c) System events.
(d) Trends.

b. Custom:

1) Daily.
2) Weekly.
3) Monthly.
4) Annual.
5) Time and date stamped.
6) Title.
7) Facility name.

C. Workstation Applications Editors:

1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:

a. Configuration.
b. Name.
c. Control parameters.
d. Set-points.

4. Scheduling:

a. Monthly calendar indicates schedules, holidays, and exceptions.
b. Allows several related objects to be scheduled and copied to other objects or dates.
c. Start and stop times adjustable from master schedule.

5. Custom Application Programming:

    a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
    b. Programming Features:

        1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
        2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
        3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
        4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
        5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
        6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
        7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
        8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
        9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.09 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:

1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:

a. Include start, stop, optimal stop, and night economizer.
b. 10 events maximum per schedule.
c. Start/stop times adjustable for each group object.

2. Exception Schedules:

a. Based on any day of the year.
b. Defined up to one year in advance.
c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.

3. Holiday or Special Schedules:

a. Capability to define up to 99 schedules.
b. Repeated annually.
c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:

1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:

a. Operator determines action to be taken for alarm event.
b. Alarms to be routed to appropriate workstation.
c. Reporting Options:

1) Start programs.
2) Print.
3) Logged.
4) Custom messaging.
5) Graphical displays.
6) Dial out to workstation receivers via system protocol.

F. Demand Limiting:

1. Building power consumption monitored from signals generated by a pulse generator, mounted at the building power meter.
2. Demand limit controlled via load shedding or load restoration in a predetermined and predictive manner.

3. Demand Reduction Methods:

    a. Supply air temperature reset.
    b. Space temperature set-point reset.
    c. Equipment off/on prioritization.

4. Relevant variables that influence demand limiting control are based on the power company methodology for computing demand charges.
5. Operator On-Line Changes Allowed:

    a. Addition and deletion of loads controlled.
    b. Changes in demand intervals.
    c. Changes in demand limit for meter(s).
    d. Maximum equipment shutoff time.
    e. Minimum equipment shutoff time.
    f. Select rotational or sequential shedding and restoring.
    g. Shed/restore priority.

6. Information and Reports available Hourly, Daily, and Monthly:

    a. Total electric consumption.
    b. Peak demand.
    c. Date and time of peak demand.
    d. Daily peak demand.

G. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

H. Sequencing: Application software based upon specified sequences of operation in Section 230993.

I. PID Control Characteristics:

1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

J. Staggered Start Application:

1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

K. Energy Calculations:

1. Accumulated instantaneous power or flow rates are converted to energy use data.

2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

L. Anti-Short Cycling:

1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

M. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

N. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

D. Control Cabinets:

1. General: Provide as required to contain all receiver controllers, relays, switches, time clocks, filter gauges, and similar devices.
2. Mounting: On walls or free standing supports.
3. Mounting Height: Top at 72 inches above floor.

4. Wiring: For panels requiring a control power source, connect to dedicated or spare circuits in electrical power panels, and provide all wiring to, in, and from control panels.

E. Control Labels:

1. General: Provide for all receiver controllers, relays, time clocks, switches, temperature transmitters, freeze protection thermostats, and control cabinets. Provide labels for all sensors and at all mechanical equipment.
2. Required Information:

a. Identifier: Corresponding to identifier used in submittal drawings.
b. Set Point: For receiver controllers, freeze protection thermostats, P-E switches, and similar devices.
c. Proportional Band: For receiver controllers.
d. Authority: For receiver controllers.

F. Sequences of Control: As specified in Section 230993. Provide process programming and data base installation.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide basic operator training on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide two (2) training sessions on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.05 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

END OF SECTION

SECTION 230934
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

E. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

F. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; 2020.

G. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems; 2022.

H. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems; 2021.

I. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

J. NEMA MG 1 - Motors and Generators; 2021.

K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

O. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

P. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to avoid placement of ductwork, piping, equipment, and other obstructions within dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate work to provide motor controllers suitable for use with motors.
3. Coordinate work to provide controllers and associated wiring suitable for interface with control devices.
4. Coordinate arrangement of electrical equipment with dimensions and clearance requirements, including sizing and providing concrete foundations and maintenance pads.
5. Verify with manufacturer that conductor terminations are suitable for use with conductors.
6. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
7. A variable frequency motor controller is synonymous with a variable frequency drive, variable speed drive, adjustable speed drive, and adjustable speed controller.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Product Data must include the following electrical data, at minimum:

a. Input voltage and phase
b. Output voltage and phase
c. Frequency
d. Power Factor
e. Nominal Power Ratings

f. Nominal Current Ratings
g. Harmonics Mitigation, if equipped
h. Disconnect size and type

B. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of controllers and adjacent equipment with required clearances indicated.
2. Include wiring diagrams showing factory and field connections.
3. Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

C. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

D. Manufacturer qualification statement.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

I. Equipment Schedule: Provide schedule of equipment supplied. Schedule must provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule must include the total quantity of each item of equipment supplied and data indicating compatibility with motors being driven. For complete assemblies, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.09 WARRANTY

A. Provide minimum 60-month manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Variable-Frequency Motor Controllers:

1. ABB: www.new.abb.com/#sle.
2. Danfoss: www.danfoss.com/#sle.
3. Eaton Corporation: www.eaton.com/#sle.
4. Rockwell Automation: www.rockwellautomation.com/
5. Schneider Electric: www.se.com/#sle.
6. Siemens Industry, Inc: www.new.siemens.com/#sle.
7. Yaskawa: www.yaskawa.com/

B. Source Limitations: Provide variable-frequency motor controllers and associated components produced by single manufacturer and obtained from single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Variable-Frequency Motor Controller:

1. Configuration: Packaged controller with integral disconnect, nonbypass, unless indicated otherwise on drawings.
2. Power Conversion System: Diode-based, 6-pulse type, unless indicated otherwise
3. Control Method: Vector; open-loop, without feedback.
4. Filtering: Provide input/line reactor and output/load reactor, where indicated.
5. Pilot Devices: Push to Test, push buttons, selector switches, and stop-lockout.

D. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

E. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

F. Single Controllers Serving Multiple Motors:

1. Control Method: Scalar/volts per hertz; do not use vector control method.
2. Provide separate overload relay for each motor; provide auxiliary contacts and control wiring as required to shut down controller upon trip of any single overload relay.
3. Consider combined length of motor leads for cable length limits.

G. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

H. Operating Requirements:

1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
3. Efficiency: Minimum of 97 percent at full speed and load.
4. Input Displacement Power Factor: Minimum of 0.97 throughout speed and load range.
5. Overload Rating:

a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.

b. Constant Torque Loads: Minimum of 150 percent of nominal for 3 seconds.

I. Power Conversion System: Microprocessor-based, pulse width modulation type.

1. Diode-based, 6-pulse type unless otherwise indicated.

J. Control System:

1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and specified status/alarm indications.
2. Provide integral operator interface for controller programming, status/alarm indications display, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:

a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.

1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
2) Vector Control: Provide selectable autotuning function.

b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
c. Selectable braking control; DC injection or flux braking.
d. Adjustable minimum/maximum speed limits.
e. Adjustable pulse width modulation switching carrier frequency.
f. Adjustable motor slip compensation.
g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
h. Automatic response to loss of speed reference; Selectable to run motor at last known speed, run motor at designated speed, or stop motor.
i. PID Control: Provide integral PID controller employing feedback for closed-loop control where indicated or required.
j. Firefighter's Override: Provide firefighter's override capability where fans are used for active smoke control or post-fire smoke removal; upon activation of designated input, operate motor at designated speed without regard to noncritical faults and other inputs; operational in both drive and bypass modes where applicable.
k. Safety Interlock: Provide permissive run safety interlock capability where indicated or required; upon activation of designated input, stop and prevent operation of motor; operational in both drive and bypass modes where applicable.
l. Damper/Valve Control: Provide damper/valve control capability where indicated or required; upon receiving motor start command, activate

designated damper/valve output and delay motor start until activation of designated end switch input confirms damper/valve operation.

4. Status Indications:

    a. Motor run/stop status.
    b. Motor forward/reverse status.
    c. Local/remote control status.
    d. Output voltage.
    e. Output current.
    f. Output frequency.
    g. DC bus voltage.
    h. Motor speed.

5. Protective Functions/Alarm Indications:

    a. Overcurrent.
    b. Motor overload.
    c. Undervoltage.
    d. Overvoltage.
    e. Controller overtemperature.
    f. Input/output phase loss.
    g. Output short circuit protection.
    h. Output ground fault protection.

6. Inputs:

    a. Digital Input(s): Three.
    b. Analog Input(s): Two.

7. Outputs:

    a. Analog Output(s): One.
    b. Relay Output(s): Two.

8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.

    a. Serial Communications: RS-485; support for Modbus RTU protocol.
    b. Ethernet Communications: Support for Modbus TCP protocol.

9. Features:

    a. Password-protected security access.
    b. Event log.

K. Power Conditioning/Filtering:

1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated, or required.
2. Provide LCL filter for IGBT-based active front end controllers.
3. Provide input surge protection.
4. Provide where indicated:

    a. Input/line reactor.
    b. Output/load reactor.
    c. Long Motor Leads:

        1) For motor leads Over 100 Feet: Provide output/load reactor.
        2) For motor leads Over 300 Feet: Provide output dV/dt filter.

5. Reactor Impedance: 3 percent, unless otherwise indicated or required.

L. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.

1. Disconnects: Circuit breaker or disconnect switch type.

    a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
    b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

2. Provide door-mounted remote operator interface.
3. Packaged Controllers with Bypass: Provide contactors and controls to enable removal of variable-frequency controller from circuit.

    a. Bypass Method: Manual, unless otherwise indicated.
    b. Bypass Configuration: 3-contactor type, with contactors for bypass, drive output, and drive input.
    c. Bypass Motor Starting Method: Full-voltage (across-the-line) with overload relay, unless otherwise indicated or required. For drive systems at 250h.p. and above, soft start bypass will be required
    d. Overload Relays: Solid state or bimetallic thermal type.

4. Pilot Devices Required:

    a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings, except where equivalent function is provided by remote operator interface.
    b. Packaged Controllers with Bypass:

        1) Bypass Mode Selector Switch: DRIVE/OFF/BYPASS.

2) Motor Control Selector Switch: HAND/OFF/AUTO.
3) Indicating Lights: For drive/bypass mode status, drive/bypass run status, and drive/bypass fault status.

M. Service Conditions:

1. Provide controllers and associated components suitable for operation under following service conditions without derating:

   a. The AC Drive shall meet IEC 60664-1 and NEMA ICS-1 Annex A standards.
   b. The AC Drive shall be designed to operate at an ambient temperature of -10 to + 40 °C (+14 to 104 °F).
   c. The storage temperature range shall be -25 to +70 ° C (-13 to +158 °F).
   d. The maximum relative humidity shall be 95% at 40 °C (104 °F), non-condensing with no dripping water, conforming to IEC 60068-2-3.
   e. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 feet (1000 meters) without derating. The manufacturer's derating factors shall apply for altitudes above 3,300 feet (1000 meters).
   f. The AC Drive shall meet environmental conditions for IEC60721-3-3, electronic cards with a protective coating.

2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

N. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as indicated on drawings, or found at the upstream panelboard or switchboard.
2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

O. Conductor Terminations: Suitable for use with conductors to be installed.

P. Enclosures:

1. Comply with NEMA ICS 6.
2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:

   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
   c. Hazardous/Classified Locations: Type 7/9, as required for classification of installed location.
   d. Plenum Locations: UL1995 with "Plenum Rated" label from NRTL certification adhered to enclosure.

3. Finish: Manufacturer's standard unless otherwise indicated.

4. Cooling: Forced air or natural convection as determined by manufacturer.
5. Enclosure Space Heaters:

    a. Provide in each controller enclosure installed outdoors and in unconditioned indoor spaces.
    b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
    c. Heater Control: Thermostat.
    d. Heater Power Source: Provide connection to transformer factory-installed in enclosure or suitable external branch circuit as indicated or as required.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters selected for actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Comply with NEMA ICS 2.
3. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
4. Trip-free operation.
5. Visible trip indication.
6. Resettable.

    a. Employ manual reset unless otherwise indicated.
    b. Do not employ automatic reset with two-wire control.

7. Bimetallic Thermal Overload Relays:

    a. Interchangeable current elements/heaters.
    b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
    c. Trip test function.

8. Solid State Overload Relays:

    a. Adjustable full load current.
    b. Phase loss protection.
    c. Phase imbalance protection.
    d. Ambient temperature insensitive.
    e. Thermal memory.
    f. Trip test function.
    g. Provide isolated alarm contact.

B. Fusible Disconnect Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1 and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated or as required.
2. Fuse Clips: As required, accept indicated fuses.

    a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

3. Provide externally operable handle with means for locking in OFF position. Provide means for locking switch cover in closed position. Provide safety interlock to prevent opening of cover with switch in ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:

1. Motor Circuit Protectors:

    a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of listed combination motor controller with overload protection; ratings, configurations, and features as indicated or as required.
    b. Provide field-adjustable magnetic instantaneous trip setting.
    c. Provide following features and accessories where indicated or where required to complete installation:

        1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
        2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
        3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
        4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
        5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2. Molded Case Circuit Breakers:

    a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated or as required.
    b. Interrupting Capacity:

1) Provide circuit breakers with interrupting capacity as required to provide short circuit current rating indicated, but not less than specified minimum requirements.
2) Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than short circuit current rating indicated.

c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
2) Provide interchangeable trip units where indicated.

d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1) Provide field-adjustable trip response settings:

(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
(b) Long time delay.
(c) Short time pickup and delay.
(d) Instantaneous pickup.
(e) Ground fault pickup and delay where ground fault protection is indicated, or where required by National Electrical Code.

e. Provide following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.04 ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.

2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each bypass motor starter, minimum.

B. Pilot Devices:

1. Comply with NEMA ICS 5; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, nonilluminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, nonilluminated type with knob operator; number of switch positions as indicated or as required.
4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:

1. Comply with NEMA ICS 5.
2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and connected auxiliary devices, plus 120 va spare capacity.
2. Include primary and secondary fuses.

2.05 SOURCE QUALITY CONTROL

A. Factory test controllers in accordance with NEMA ICS 61800-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the variable frequency motor controller is not damaged or otherwise compromised. Do not install damaged equipment.

C. Verify that the ratings of controllers are consistent with indicated requirements.

D. Verify that mounting surfaces are ready to accept controllers.

E. Verify that installation conditions are satisfactory before starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

D. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

E. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70. Coordinate with other equipment and disciplines.

F. Install equipment such that the heights of operating handles are no more than 78 inches above finished floor.

G. Provide required support and attachment in accordance with Section 260529.

H. Install controllers plumb and level.

I. Unless otherwise indicated, mount floor-mounted controllers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.

J. Provide grounding and bonding in accordance with Section 260526. Per NEMA ICS 7.2, controller must be solidly grounded to the main distribution.

K. Install field-installed devices, components, and accessories.

L. Provide fuses complying with Section 262813 for fusible switches, or as indicated.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

O. Set field-adjustable circuit breaker tripping function settings per manufacturerer, unless otherwise indicated.

P. Provide control wiring between variable frequency motor controller and external equipment, remote devices, switches, lights, and other accessories.

Q. Provide variable frequency motor controller identification and nameplates per Section 260553.

3.03 FIELD QUALITY CONTROL

A. A factory-authorized service center shall provide each drive with certified factory start-up. A certified start-up form shall be filled out for each drive, with a copy provided to the owner and a copy kept on file with the manufacturer.

B. Specified products shall be tested as a system to conform to specification requirements before scheduling the acceptance tests. The Contractor shall conduct performantece verification tests with a customer representative, observing and documenting complete system compliance to the specifications.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.17. An insulation-resistance test on control wiring is listed as optional and is not required.

E. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

F. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 800 amperes. Tests listed as optional are not required.

G. Packaged Controllers with Bypass: Test for proper operation in both drive and bypass modes.

H. Correct deficiencies and replace damaged or defective controllers or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Program the variable frequency motor controller per the sequence of operations, alarms, display, and events.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Location: At project site.

3.07 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION

SECTION 231123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

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

B. Section 099113 - Exterior Painting.

C. Section 230553 - Identification for HVAC Piping and Equipment.

D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2019.

B. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.

C. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

D. ANSI Z223.1 - National Fuel Gas Code; 2024.

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 DEFINITIONS

A. Exposed, Exterior Installations: Exposed exterior installation refers to the placement or installation of various fixtures, materials, or components in such a manner that they are directly exposed to outdoor environmental conditions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type E, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

B. Flexible Gas Piping:

1. Corrugated Stainless Steel Tubing: Series 300 stainless steel tubing, ASTM A 240/A 240M, corrugated.
2. Protective outer jacket: Comply with ANSI LC 1/CSA 6.26.
3. Comply with ASTM E84.
4. Fittings: Provided by piping system manufacturer.
5. Provide piping with integral lightning protection.
6. Manufacturers:

a. Omega Flex, Inc; TracPipe CounterStrike
b. Parker Hannifin Corporation; Parflex Division.
c. FlashShield Products; Gastite, a division of Titeflex Corp.
d. Tru-Flex Metal Hose Corp.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

C. Dielectric Connections:

1. Unions:

a. Galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier, ASSE 1079.
b. Suitable for the required operating pressures and temperatures. Minimum pressure rating of 150 psig at 180 deg F.

2. Flanges:

a. Bolted, companion-flange style factory fabricated, ASSE 1079. Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous end connections.
b. Suitable for the required operating pressures and temperatures. Minimum pressure rating of 150 psig at 180 deg F.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2.04 BALL VALVES

A. Manufacturers:

1. Apollo Valves.
2. Milwaukee Valve Company.
3. Nibco, Inc.

B. Construction, 4 Inches and Smaller: MSS SP-110, ASTM B584, 600 psi CWP, bronze body, chrome plated bronze or stainless steel ball, full port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.

C. Initials "WOG" shall be permanently marked on valve body.

2.05 BRONZE PLUG VALVES

A. Manufacturers:

1. McDonald, A. Y. Mfg. Co.

B. Construction: 1-1/2 inches and Smaller: MSS SP-78, 125 psi CWP, bronze body and plug, ASTM B 584, flat tee head operator, threaded or flanged ends.

C. Initials "WOG" shall be permanently marked on valve body.

2.06 CAST IRON PLUG VALVES

A. Manufacturers:

1. Flowserve.
2. Homestead Valve; a division of Olson Technologies, Inc.
3. McDonald, A. Y. Mfg. Co.
4. Milliken Valve Company.
5. Mueller Co.; Gas Products Div.
6. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

B. Construction 2 Inches and Larger: MSS SP-78, 125 psi CWP, cast iron body and plug, ASTM A 126, Class B, pressure lubricated, Teflon or Buna N packing, flanged or threaded ends. Provide lever operator with tamperproof set screw.

C. Initials "WOG" shall be permanently marked on valve body.

2.07 ELECTRICALLY OPERATED SOLENOID TYPE VALVES

A. Manufacturers:

1. ASCO Power Technologies, LP; Division of Emerson.
2. Eclipse Combustion, Inc.
3. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
4. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

B. Construction: UL 429 pilot operated, brass or aluminum body, stainless steel springs and valve trim, nitrile rubber seat and disc, NEMA Type 4 enclosure.

C. Visual position indicator.

2.08 STRAINERS

A. Size 2 inch and Under:

1. Class 150, threaded bronze or carbon steel body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch and larger:

1. Class 125, flanged carbon steel or iron body, Y pattern with 1/16 inch stainless steel perforated screen.

2.09 GENERATOR GAS PRESSURE REGULATOR

A. Manufacturers:

1. Itron (Actaris) – Series B34
2. Sensus – Series 243
3. American Meter – Series 1800

B. Comply with ANSI Z21.80.

C. Construction: Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator. Listed for use with Gas Engines.

D. Cast iron or die-cast aluminum body and diaphragm case. Springs and Diaphragms: Zinc- palted steel

E. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

F. Orifice: Aluminum; interchangeable.

G. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

H. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.

I. Overpressure Protection Device: Factory mounted on pressure regulator.

J. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

K. Regulator to be Rapid Response Type.

L. Maximum Inlet Pressure 5 psig

2.10 APPLIANCE FLEXIBLE CONNECTORS

A. Comply with ANSI Z21.75 for Outdoor, Appliance Flexible Connectors

B. Comply with ASME B1.20.1 for Threaded Ends

C. Corrugated stainless-steel tubing with polymer coating and zinc coated steel end fittings

D. Operating-Pressure Rating: 0.5 psig.

E. Maximum Length: 72 inches

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 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. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with the International Fuel Gas Code, International Mechanical Code, NFPA 54, NFPA 99, and manufacturer's written instructions.

B. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

C. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Do not install piping running through any elevator shaft, public stairway, stair landing, or means of egress.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Group piping whenever practical at common elevations.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. A continuous warning means shall be provided above the buried pipeline at approximately one half the depth of burial.

K. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood and insect screen unless provided with vent limiting devices. Vent line pipe sizing to follow the requirements of the regulator manufacturer.

O. Terminate all vent pipes outside of the building, not less than ten feet measured vertically or horizontally from any building opening, not less than twenty five feet from any outside air intake louver, not less than eight feet above a roof line or grade, and with a weatherproof and flameproof vent cap or hood.

P. Conceal pipe installations within walls, pipe spaces, utility areas, above ceilings, below grade or floors, and in floor channels unless explicit exposure is indicated.

Q. When installing concealed natural gas piping and piping beneath the building, employ containment conduit made of steel pipe with welded joints. Install a vent pipe from the containment conduit to the outdoors, terminating it with a weatherproof vent cap.

R. Utilize eccentric reducer fittings for reducing pipe sizes and ensure they are installed with the flat side down.

S. Connect branch piping from the top or side of horizontal piping.

T. Never employ natural gas piping as a grounding electrode.

U. Install components with pressure rating equal to or greater than system operating pressure.

V. Provide access where valves and fittings are not exposed.

1. Coordinate size and location of access doors with Section 083100.

3.04 APPLICATION

A. Install main shutoff gas valve at the first available location inside the building or tenant space which is readily accessible with a permanently attached handle.

B. Install valves with stems upright or horizontal, not inverted.

C. Install unions downstream of valves and at equipment or apparatus connections.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Install an electrically operated solenoid type valve upstream of gas appliances where required to comply with ASME CSD-1.

G. Provide tamperproof locking feature for valve handles exposed to the public.

H. Incorporate fittings to accommodate changes in direction and branch connections within the natural gas piping system.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Install a strainer on the inlet of each line-pressure regulator and automatic or electrically operated valve.

K. Install sediment traps and drips at points where condensate might accumulate, including service-meter outlets. Position them for easy access and maintenance, avoiding locations prone to freezing.

1. Construct drips and sediment traps using tee fittings with a plugged or capped bottom outlet. Use a nipple with a minimum length of 3 pipe diameters, but not less than 3 inches long, matching the connected pipe size. Leave space below the bottom of the drip for plug or cap removal.

L. Place a pressure gauge downstream from each service regulator.

M. Provide union on regulator inlet or outlet and include capped or plugged test tee on outlet.

N. Gas pressure regulators without integral vent limiter shall be vented to outside atmosphere.

3.05 IDENTIFICATION

A. Install detectable yellow warning tape directly above fuel-oil piping, 12 inches below finished grade, except below subgrade under pavements and slabs. Terminate tracer wire in an accessible area, and identify as "tracer wire" for future use with plastic-laminate sign.

B. Identify above grade piping systems as specified in Section 230553.

3.06 PAINTING

A. Unless stated differently herein, comply with requirements in Division 9 for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Topcoat: Exterior alkyd enamel (semigloss).
c. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.07 SCHEDULES

A. Outdoor Piping Schedule:

1. Aboveground natural-gas piping shall be one of the following:

a. Steel pipe with malleable-iron fittings and threaded joints.
b. Steel pipe with wrought-steel fittings and welded joints.

B. Piping Schedule for Regulator Vents:

1. Aboveground, regulator vent piping shall be one of the following:

a. Steel pipe with steel welding fittings and welded joints.
b. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

2. Flexible corrugated stainless-steel tubing (unless stated differently from manufacturer's installation instructions:

    a. Pipe Size: 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.08 FIELD QUALITY CONTROL

A. See Section 014000-Quality Requirements for additional requirements.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Equipment and piping shall be stored indoors in a warm, clean, dry place protected from weather, construction traffic, dirt, dust, water, and moisture. If equipment or piping to be stored for more than 6 months, manufacturer’s instruction for long-term storage shall be followed.

D. Perform the following piping pressure tests in accordance with NFPA 31 and NFPA 54 and summarized below:

1. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.
2. Provide all piping, fittings, blind flanges, and equipment necessary to perform the testing. Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated herein; additional time may be necessary to conduct an examination for leakage. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
3. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.
4. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.
5. The test pressure to be used shall be no less than 11/2 times the proposed maximum working pressure, but not less than 25 psig, irrespective of design pressure. Where the test pressure exceeds 125 psig, the test pressure shall not

exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

6. Test duration shall be not less than 2 hours.
7. All pressure tests are to be documented and included in O&M Manuals.
8. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not tested up to the active system.

E. Piping and equipment will be considered defective if unit or components do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Remove and replace damaged or malfunctioning items and retest as specified above.

3.09 CLEANING

A. See Section 017419-Construction Waste Management and Disposal for additional requirements.

B. After construction and painting is completed, clean exposed surfaces of pipe and specialties.

C. Touch-up marred or scratched surfaces of factory-finished pipe and specialties using finish materials furnished by the manufacturer.

3.10 CLOSEOUT ACTIVITIES

A. See Section 017800-Closeout Submittals for closeout submittals.

B. See Section 017900-Demonstration and Training for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

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SECTION 233100
HVAC DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 099113 - Exterior Painting: Weld priming, weather resistant, paint or coating.

D. Section 099123 - Interior Painting: Weld priming, paint or coating.

E. Section 230130 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

F. Section 230713 - Duct Insulation.

G. Section 233300 - Air Duct Accessories.

H. Section 233700 - Air Outlets and Inlets.

1.03 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. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE Std 90.1 I-P-2019 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019, with Errata and Addenda (2021).

D. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.

E. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 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, with Editorial Revision.

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 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).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

M. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

N. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

P. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

Q. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

R. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

S. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

U. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide data for duct materials and duct connections.

D. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate , following SMACNA (LEAK).

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, construction, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated.

C. Duct Sealing and Leakage in accordance with Static Pressure Class:

1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:

    a. Supply Air:

        1) 4 in-wc positive pressure class, SMACNA Seal Class A.

    b. Return Air:

        1) 3 in-wc negative pressure class, SMACNA Seal Class B.
        2) 3 in-wc negative pressure class, SMACNA Seal Class A if located outdoors.

D. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
4. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

    a. Where black steel shapes and plates and galvanized steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

5. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.02 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide “Paint Grip” finish for ductwork that will be painted.
2. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round ductwork 12” in diameter and below may be 26 gauge where allowed in SMACNA (DCS). Specific applications requiring different gauge thickness of sheet metal are listed herein.

B. Rectangular Metal Duct:

1. Rectangular Single Wall: Rectangular galvanized steel with Pittsburgh lock seams.

C. Round Metal Ducts:

1. Round Single Wall Duct: Round longitudinal lock seam or round spiral seam duct with galvanized steel wall. Round spiral lock seams allowed on duct diameters less than 10 inches. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

    a. Fittings: Manufacture at least two gauges heavier metal than the duct.
    b. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

D. Connectors, Fittings, Sealants, and Miscellaneous:

1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

    a. Manufacturers:

        1) Carlisle HVAC Products; Nexus Flange Connectors with Sealant Pocket
        2) Ductmate Industries, Inc, a DMI Company
        3) Elgen Manufacturing Company, Inc
        4) MKT Metal Manufacturing

3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

    a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
    b. VOC Content: Not more than 250 g/L, excluding water.
    c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
    d. For Use with Flexible Ducts: UL labeled.
    e. Manufacturers:

        1) Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant
        2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality
        3) Ductmate Industries, Inc, a DMI Company
        4) Elgen Manufacturing Company, Inc; Duct Sealer

4. Gasket Tape:

    a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
    b. Manufacturers:

        1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape
        2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket Tape

2.03 FLEXIBLE DUCTS

A. Vapor Barrier Insulated Flexible Air Ducts:

1. UL 181, Class 1, two-ply polyester or vinyl film supported by helically wound spring steel wire.
2. Insulation: Fiberglass insulation with polyethylene vapor barrier core.
3. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
4. Maximum Velocity: 4,000 fpm.
5. Temperature Range: Minus 20 to 210 degrees F.

2.04 SUPPORTS AND HANGERS

A. Hanger Rods within Noncorrosive Environments: Cadmium-plated steel nuts and rods.

B. Strap and Rod Sizes: Comply with SMACNA HVAC Duct Construction Standards (DCS)

1. Strap material to match duct material.

C. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials (e.g. galvanized duct/nickel plated hardware; stainless steel duct/SS hardware; aluminum ductwork/aluminum or SS screws.)

E. Steel Cables Suspension Systems: Galvanized or stainless steel manufactured cable and fastener system.

1. Manufacturers

a. Gripple Inc.
b. Ductmate Industries, Inc..

2. Conklin Metal Industries International, LLC
3. Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
4. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

    a. Type ZA2 Zinc housing
    b. Wedge: Sintered steel hardened to minimum 5 Rockwell C.
    c. Spring: Type 302 Stainless Steel
    d. End Cap: Cable Spec No. 1-4 – UV stabilized homopolymer propylene; Cable Spec No. 5 – Type ZA2Zinc.

5. Duct Attachments: Manufactured components for attachment to ductwork systems (TDC, TDF, etc.); compatible with duct materials (e.g. galvanized duct/nickel plated hardware; stainless steel duct/SS hardware; aluminum ductwork/aluminum or SS screws.)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products following the manufacturer's written instructions.

B. Drawings depict the general layout of ducts, fittings, and associated components. Place air outlets and inlets in the specified locations to meet design criteria for air volume, noise levels, airflow patterns, throw, and pressure drop, whenever possible. When installing units in lay-in ceiling panels, position them at the center of the panel. In cases where architectural elements or other objects pose conflicts during installation, promptly inform the Architect for a decision on the final placement.

C. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

D. Install, support, and seal entire ductwork system in accordance with NFPA 96 and SMACNA (DCS).

1. All joints, longitudinal and transverse seams, and connections in metallic ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), liquid sealants, or tapes.
2. Where ducts are exposed, trim duct sealants level with the metal, achieving a uniform and smooth exposed bead. Use of a two-part tape sealing system is prohibited.

E. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA (DCS), Figure 4-7, except do not reduce duct to less than four inches in any dimension and do not exceed an 4:1 aspect ratio. In all cases, seal to prevent air leakage.

F. Install ducts with fewest possible joints.

G. Comply with safety standards NFPA 90A and NFPA 90B.

H. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

I. Install ducts in both vertical and horizontal orientations, conforming to parallel and perpendicular alignments with the building's structural lines unless otherwise indicated.

J. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

K. Comply with SMACNA (DCS) Figure 2-2 for rectangular elbow construction.

L. Comply with SMACNA (DCS) Figure 3-3 for round elbow construction.

M. Duct Branch Connections

1. Rectangular main to rectangular branch configuration to utilize 45 degree high efficiency fitting.
2. Rectangular main to round branch configuration to utilize conical fitting.
3. Round main to round branch with duct velocity 1500 fpm or lower to utilize a conical fitting.
4. Round main to round branch with duct velocity over 1500 fpm to utilize a 45 degree lateral fitting.

N. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 233300. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

O. Where rectangular mitered elbows are used, provide turning vanes in accordance with Section 233300.

P. To minimize fan energy, consideration must be given to the lowest practical velocity and pressure criteria which will provide adequate service. In general, size ductwork to maintain a maximum pressure drop of 0.08’ per 100 lineal feet of ductwork.

Q. Do not route ducts through transformer vaults, electrical equipment rooms and enclosures, or paths of egress.

R. Flexible Ducts: Connect to metal ducts with draw bands.

S. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

T. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

U. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities. At a minimum, install ducts with a clearance of 2 inches, plus allowance for insulation thickness.

V. Connect diffusers to low-pressure ducts with 5 feet maximum length of flexible duct held in place with clamp.

W. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

X. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

Y. Install all motor operated dampers and connect to or install all equipment furnished by others.

Z. Where ducts pass through non-fire-rated interior partitions and walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

AA. Where ducts pass through fire-rated interior partitions, walls, and exterior walls, install life safety dampers. Comply with requirements of the latest version of the international building code, Section 078400 for firestopping, and Section 233300 for life safety dampers.

BB. Coordinate with Division 11 equipment specifications for venting corrosives storage cabinets.

CC. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

DD. Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

3.02 METAL DUCT SCHEDULE

A. Supply Air Ducts:

1. G90 Galvanized Duct unless noted otherwise.

B. Return Air Ducts:

1. G90 Galvanized Duct unless noted otherwise.

3.03 SUPPORTS AND HANGERS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Support vertical ducts with channel or steel angles secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 15 feet.

C. Provide 4” wide concrete base around vertical ductwork penetrating a floor which is not concealed within a shaft or chase to minimize unexpected water or other fluids migrating to a lower level.

D. Use double nuts and lock washers on threaded rod supports.

E. Mount ductwork supports on the roof following the installation instructions provided by the manufacturer, with a maximum spacing of 6 feet. Coordinate secured mounts with roofing contractor for adherence to the roof structure and flashing of posts penetrating roofing membrane.

3.04 FIELD QUALITY CONTROL

A. See Section 014000-Quality Requirements for additional requirements.

B. Remove and replace damaged or malfunctioning items and retest as specified above.

C. Perform leakage tests in compliance with SMACNA's "HVAC Air Duct Leakage Test Manual", Figure 4-1; Table 4-1; and Appendix ‘E’. Submit a test report for each test.

1. Test the following systems:

a. Supply Ducts with a Pressure Class of positive 3 inch w.g. or higher: Test no less than 25 percent of total installed ductwork.
b. Return Ducts with a Pressure Class of negative 3 inch w.g. or higher: Test no less than 25 percent of total installed ductwork.

2. Leakage rate shall not exceed more than 5% of the system air quantity for ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
3. Disassemble, reassemble, and seal ductwork to accommodate leakage testing requirements.
4. Perform testing prior to installing external insulation.
5. Conduct tests at static pressures equal to maximum system design pressure of system or section being tested.
6. Submit a signed report to the Owner and Engineer and include a copy within the O&M Manual indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

3.05 PAINTING

A. Prepare ductwork identified for painting by removing all oils, dirt, etc. from surfaces to be painted.

B. Paint interior of metal ducts that are visible through grilles and registers and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Refer to Division 09 specifications for paint materials and application requirements.

3.06 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean thoroughly all new and existing duct systems. See Section 230130.

C. Clean duct system by forcing air at high velocity through duct to remove accumulated dust. Clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters or bypass during cleaning.

END OF SECTION

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SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct test holes.

B. Flange connectors.

C. Flexible duct connectors.

D. Electrically actuated remote damper operators.

E. Volume control dampers.

1.02 RELATED REQUIREMENTS

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

B. Section 078400 - Firestopping.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

D. Section 233100 - HVAC Ducts and Casings.

E. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

F. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

G. Section 284600 – Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).

C. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

F. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).

G. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).

H. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

I. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

L. Bluetooth CS - Bluetooth Core Specification; 2016, Addendum 2017.

M. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.

N. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).

O. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).

P. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.

Q. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

R. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

S. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.

V. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

W. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

X. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

Y. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

Z. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

AA. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

BB. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

CC. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.

DD. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

EE. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

D. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.

E. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

F. Project Record Drawings: Record actual locations of access doors.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 DUCT TEST HOLES

A. Temporary Test Holes: Drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.02 FLANGE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Ward Industries, Inc.; a division of Hart & Cooley, Inc

B. Factory-fabricated with slide-on transverse flange gaskets, connectors, and components.

C. Gauge, shape, material to match connecting ductwork.

2.03 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Hypalon Fabric (Extended Outdoor UV Stable)
2. Ductmate Industries, Inc, a DMI Company
3. Duro Dyne Inc.
4. Ventfabrics, Inc.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A.

a. Net Fabric Width: Approximately 3 inches wide.
b. Material for inside applications other than corrosive environments or fume exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard.
c. Material used for outdoor applications other than corrosive environments or fume exhaust to be double coated with Hypalon, air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal wight of 26 ounces per square yard.
d. For corrosive environments or fume exhaust applications indoors or outdoors, use a material coated with Teflon that is air and water tight, suitable for temperatures between -20°F and 500°F, and has a nominal weight of 14 ounces per square yard.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch.

2.04 ELECTRICALLY ACTUATED REMOTE DAMPER OPERATORS

A. Manufacturers:

1. Young Regulator.
2. Greenheck Fan Corporation.
3. Metropolitan Air Technology.

B. 9-volt actuator driven damper with RJ11 cables for remote adjustment from recessed gear actuator. Control cable located external of the duct.

C. Power Supply: Provide one portable battery operated power supply for damper adjustment and position indication.

D. RJ11 cable with plenum rating where required.

E. Recessed mount for wall or ceiling installation with stainless steel cover plate.

2.05 VOLUME CONTROL DAMPERS

A. Products for Automatic Controls: See Section 230913.

B. Manufacturers:

1. McGill AirFlow LLC.

2. Metalaire, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ruskin Company.
6. Pottorff.

C. Fabricate in accordance with SMACNA (DCS) and as indicated.

D. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.
2. Blade: 24 gauge, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

1. Blade: 18 gauge, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 24 inches provide regulator at both ends.

H. Constant Airflow Regulators:

1. General Requirements:

a. Provide bi-directional, air balancing regulator for pressure independent air volume control.
b. Complies with UL 2043 for heat and smoke release.
c. Complies with AMCA 500-D for the allowable leakage rates.
d. Airflow regulator to be field adjustable.

2. Construction:

a. Nominal Diameter: 4 inch to 6 inch.
b. Frame: Thermoplastic resin in compliance with UL 94.
c. Blade: Thermoplastic resin in compliance with UL 94.
d. Bearings: Hydraulic blade dampener.
e. Outer Seal: Removable rubber gasket-type around circumference of damper.

f. Spring: Stainless steel leaf-type.
g. Temperature Range: 25 to 150 degrees F .
h. Operating Range: 0.2 to 2 in-wc.

3. Accessories:

a. Provide airflow regulators with rectangular to round transitions.

4. Manufacturers:

a. Ruskin ABD.
b. Greenheck Fan Corporation ABD.
c. Pottorff CAR.
d. Young Regulator CVR/CVP.
e. Automatic Airflow Balancing, a brand of Metal Industries Inc; ABV.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

B. Verify that surfaces are suitable for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Install duct accessories made from materials that are compatible with the duct materials. Use galvanized-steel accessories for galvanized-steel and fibrous-glass ducts, stainless-steel accessories for stainless-steel ducts, and aluminum accessories for aluminum ducts.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 16 inch by 16 inch size access door for hand and shoulder access, or as indicated on drawings. Access doors to open against duct static pressure. Label access doors.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

1. See Section 230548.

G. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.03 FIELD QUALITY CONTROL

A. See Section 014000-Quality Requirements for additional requirements.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Units shall be stored indoors in a warm, clean, dry place protected from weather, construction traffic, dirt, dust, water, and moisture. If unit(s) to be stored for more than 6 months, manufacturer’s instruction for long-term storage shall be followed.

D. Units will be considered defective if unit or components do not pass tests and inspections.

E. Remove and replace damaged or malfunctioning items and retest as specified above.

F. Prepare test and inspection reports.

3.04 CLEANING

A. See Section 017419-Construction Waste Management and Disposal for additional requirements.

B. After construction and painting is completed, clean exposed surfaces of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800-Closeout Submittals for closeout submittals.

B. See Section 017900-Demonstration and Training for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

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SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Registers/grilles:

1. Ceiling-mounted, supply register/grilles.
2. Ceiling-mounted, return register/grilles.

1.02 RELATED REQUIREMENTS

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

B. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

C. Section 265100 - Interior Lighting: Air handling light troffers.

1.03 REFERENCE STANDARDS

A. ACGIH (IV) - Industrial Ventilation: A Manual of Recommended Practice for Design, 31st Edition; 2023, with Errata (2025).

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

D. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

E. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

H. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

I. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

L. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

O. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

D. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 PERFORATED FACE CEILING GRILLES

A. Manufacturers:

1. Krueger.
2. Nailor Industries Inc.
3. Price Industries.
4. Titus.
5. Tuttle & Bailey

B. Type: Perforated face with fully adjustable pattern and removable face.

C. Frame: As indicated on drawings. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: As indicated on drawings.

E. Color: As indicated on drawings.

F. Accessories: Radial opposed blade

1. Sectorizing baffle.
2. Safety chain.
3. Wire guard.
4. Multi-louvered equalizing grid.
5. Operating rod extension.
6. Gaskets for surface mounted diffusers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect locations designated for the installation of diffusers, registers, and grilles to ensure they meet installation tolerance standards and other conditions that impact equipment performance.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Drawings depict the general layout of ducts, fittings, and associated components. Place air outlets and inlets in the specified locations to meet design criteria for air volume, noise levels, airflow patterns, throw, and pressure drop, whenever possible. When installing units in lay-in ceiling panels, position them at the center of the panel. In cases where architectural elements or other objects pose conflicts during installation, promptly inform the Architect for a decision on the final placement.

C. Install diffusers, registers, and grilles to allow for easy service and maintenance of dampers, air extractors, and life safety dampers.

D. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

E. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement. Ensure that diffusers, registers, and grilles are installed in a level and plumb manner.

F. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ductwork.

G. Install diffusers to ductwork with air tight connection.

H. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

I. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

J. Hanger and Supports

1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
3. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

SECTION 234000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable, extended surface pleated panel filters.

B. Extended surface high efficiency media filters.

C. Filter frames and housings.

D. Filter gauges.

1.02 RELATED REQUIREMENTS

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

B. Section 253523 - Integrated Automation Control Dampers: Industrial-grade, bubble-tight dampers.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 850 (I-P) - Performance Rating of Commercial and Industrial Air Filter Equipment; 2013 (Reaffirmed 2023).

B. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment; 2013 (Reaffirmed 2023).

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

D. UL 586 - High Efficiency, Particulate, Air Filter Units; Current Edition, Including All Revisions.

E. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods; 2015b.

F. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

D. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

E. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

F. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Filters: One set of each type and size.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

2.02 DISPOSABLE, EXTENDED SURFACE PLEATED PANEL FILTERS

A. Manufacturers:

1. AAF International.
2. Camfil Farr.
3. Flanders-Precisionaire.

B. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid by corrugated aluminum separators.

C. Casing: Non-flammable beverage board.

D. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.

E. Holding Frames: 20 gauge, 0.0359 inch minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.

2.03 EXTENDED SURFACE HIGH EFFICIENCY MEDIA FILTERS

A. Manufacturers:

1. AAF International.
2. Camfil Farr.
3. Flanders-Precisionaire.

B. Media: UL 900 Class 1 pleated, rigid cell box type, non-woven cotton fabric, scrim reinforced; supported by welded steel retainer; in 16 gauge, 0.0598 inch steel holding frame with corrosion resistant coating.

C. Minimum Efficiency Reporting Value (MERV): 14, when tested in accordance with ASHRAE Std 52.2.

2.04 FILTER FRAMES AND HOUSINGS

A. General: Fabricate filter frames and supporting structures of 16 gauge, 0.0598 inch galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

B. Provide for interchangeability of filter media of other manufacturers; for panel filters, minimum 2 inches thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

C. Front Access Filter Frames:

1. Galvanized-steel framing members with access upstream (front) filter servicing, prepunched or cut to size for assembly into modules with positive sealing gaskets. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.
2. Frames for MERV 13 or MERV 14 filters to have provisions for installation of MERV 7 or MERV 8 prefilters upstream of high efficiency media. Secure prefilters by means of spring clips or a spring loaded mechanism. Spring clips or latches shall be on the upstream side of the prefilter. Provide leakproof gaskets between prefilter media and holding frame.

2.05 FILTER GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc.
2. Airguard.
3. H.O. Trerice Co.

4. Weiss Instruments.

B. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range as listed below with 2 percent of full scale accuracy.

1. Scale Range for Filter Media Having a Recommended Final Resistance up to 2.0-Inch wg: 0- to 2.0-inch wg.

C. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's written instructions.

B. Prevent passage of unfiltered air around filters with rubber or neoprene gaskets.

C. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan systems during the construction period.

E. New clean filter media shall be installed prior to start of air balancing.

F. Deliver one new set of media per unit to the owner prior to substantial completion.

G. The filter assembly shall be leak tested and factory certified per referenced ASME and IES standards.

END OF SECTION

SECTION 237416
PACKAGED LARGE ROOF ROOFTOP UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged roof mounted air-handling units.

1.02 RELATED REQUIREMENTS

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

B. Section 077200-Roof Accessories: Roof adapter curb.

C. Section 230513-Common Motor Requirements for HVAC Equipment.

D. Section 230593-Testing, Adjusting, and Balancing for HVAC.

E. Section 230913 - Instrumentation and Control Devices for HVAC.

F. Section 233300-Air Duct Accessories: Flexible duct connections.

G. Section 234000-HVAC Air Cleaning Devices.

H. Section 230934-Variable-Frequency Motor Controllers.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.

G. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 230500 - Common Work Results for HVAC for additional submittal requirements.

C. Product Data:

1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
6. Certified coil-performance ratings with system operating conditions indicated.
7. Provide calculations for required base rail heights to allow for proper condensate trapping per condensate drain details.
8. Dampers, including housings, linkages, and operators.
9. Filters with performance characteristics.
10. Building Automation System sequence of operations and points list

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Manufacturer's Instructions: Include installation instructions.

F. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000-Product Requirements for additional provisions.
2. Extra Fan Belts: One set for each unit.
3. Extra Filters: One set for each unit.
4. Extra Compressor: One set for each unit.
5. Extra Supply Fan Motor: One set for each unit.

6. Extra Condenser Fan Motor: One set for each unit.
7. Extra Contactors: Six sets for each unit.
8. Extra Circuit Board: One set for each unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.07 WARRANTY

A. See Section 017800-Closeout Submittals for additional warranty requirements.

B. Manufacturer's standard warranty form in which manufacturer agrees to repair or replace components (parts and labor) of rooftop units that fail in materials or workmanship within specified period.

1. Warranty Provided: One year from date of Substantial Completion.
2. Compressor Warranty Period: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Roof adapter curbs shall be guaranteed against defects in material and/or workmanship for a period of five (5) years.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. The units shall be constructed for outdoor installation.

C. Configuration: Fabricate and assemble the rooftop unit with accessories and components as indicated on the Drawings.

D. Base performance on sea level conditions, unless otherwise scheduled.

E. Fabrication: Conform to AMCA 99 in the absence of direction in this Specification.

F. Performance: Refer to schedule in Drawings.

G. Provide a unit with a total footprint size (length and width) that will not exceed the one shown on the Drawings, including the height of individual unit components.

H. Through properly designed access; ease of maintenance, removability of components, and unit serviceability shall be assured.

I. The use of support members framed within the unit casing which will allow for trapping of debris between the supports and casing will not be allowed. Unit insulation must be completely encapsulated.

J. The unit is to be shipped factory assembled in one complete section, when possible. If necessary to ship the unit in sections, due to rigging or shipping constraints, the unit is to be designed to minimize the number of sections.

K. The unit sizes shown on drawings are established based on unit performance, structural, and access requirements and are not to be altered.

2.02 MANUFACTURERS

A. Manufacturers:

1. AAON.
2. Trane.

2.03 BASE

A. The unit shall be constructed on a G-90 galvanized steel structural base. The base shall be designed to distribute loads properly to a suitable mounting surface and be braced to support internal components without sagging, pulsating, or oil canning.

B. Unit floor shall be constructed of no lighter than 18-gauge G-90 galvanized steel. The base floor is to be supported with adequate stiffening members to prevent oil canning. Caulking, gaskets and mechanical fasteners to guarantee seals and water tightness of joints will not be acceptable.

C. Cooling coil sections or other sections where collection of water may result shall be provided with sloped stainless steel drain pans. Pans to be welded and waterproof to serve as a drain pan to prevent building water damage from the unit capable of retaining minimum 1-1/2” of water without leakage. Pan to be double sloped (minimum of 1/4” per foot) towards drain outlet. Width of pan to be equal to width of unit. Length of pan to be 36 inches or as required per ASHRAE 62.1. Drain pan length to include the coil length plus the coil headers. Depth of pan at perimeter to be a minimum of 2 inches. The underside of the pans to be insulated as described below.

1. Minimum connection size: 1” NPS, threaded.

2. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

D. The underside of the base perimeter shall be insulated with minimum 2” thick 1-1/2 pound per cubic foot density, foam injected, or polyisocyanurate insulation to form a complete vapor barrier. Vapor barrier is then protected by a 22-gauge G-90 galvanized steel attached to the bottom of the base.

E. Unit to be provided with properly located permanent lifting plates or removable lifting lugs for each section to adequately allow rigging of the unit sections in place.

2.04 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction:

1. Outside Casing Wall and Roof: G90 galvanized steel, minimum 24 gauge thick with manufacturer's standard finish pre-coated to withstand 2,500 hours of salt spray per ASTM B-117 test procedure.
2. Inside Casing Wall: G90 galvanized steel minimum 24 gauge thick.
3. Floor Plate: G90 galvanized steel minimum 18 gauge thick.
4. Casing Insulation:

    a. Materials: Injected polyurethane foam insulation.
    b. Casing Panel R-Value: Minimum 13.
    c. Insulation Thickness: 2 inches.
    d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
    e. Corrosion and moisture resistant, vermin proof and non-combustible per ASTM #E84.

C. Thickness of panel skin, core density, rib structural frame spacing shall be regulated to eliminate panel pulsation and restrict the maximum deflection to 1/200 of any span at design load of 1-1/2 times the design positive or negative pressure plus snow and wind loading.

D. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360.

E. Completed enclosures shall contain no insulation voids in joints between panels. Manufacturers furnishing individual panels with an open male channel shall fill the open channel with insulation as herein before specified which shall be attached permanently to the panel. Any insulation which becomes detached from the panels

during shipment or handling shall be furnished by enclosure manufacturer and installed by the contractor at no additional cost to the Owner.

F. Any equipment flashing, internal partitions or other attachments to the casing shall be made in such a way as to ensure a permanent leak-tight connection.

G. Pipe and conduit penetrations through the unit casings shall be provided by the unit manufacturer and be properly sealed prior to leaving the factory. Penetrations sealed on site by caulking around extensions are not acceptable.

H. Under 55°F supply air temperature and design conditions on the exterior of the unit of 91°F dry bulb and 74°F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying or replacing units should external condensate form on them.

2.05 ROOF SYSTEM

A. Double-Wall Construction:

1. Outside Casing Wall and Roof: G90 galvanized steel, minimum 24 gauge thick with manufacturer's standard finish pre-coated to withstand 2,500 hours of salt spray per ASTM B-117 test procedure,
2. Inside Casing Roof: G90 galvanized steel, minimum 24 gauge thick.
3. Casing Insulation:

    a. Materials: Injected polyurethane foam insulation.
    b. Insulation Thickness: 2 inch.
    c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
    d. Corrosion and moisture resistant, vermin proof and non-combustible per ASTM #E84 and shall have the following ratings based on NFPA No. 255:

        1) Flame Spread - 15
        2) Smoke Developed - 0
        3) Fuel Contributed- 0

B. Unit roofs for outdoor units are to be sloped to assure positive run-off. Provide rain break above access doors.

2.06 ROOF ADAPTER CURBS

A. Frames:

1. Material: ASTM A 653 G90 hot-dipped galvanized steel. Minimum 18 gauge or heavier as engineered by manufacturer.
2. Corners: Mitered and welded. Welds micro-sealed and prime painted after fabrication.
3. Covered areas are sloped for water runoff and reinforced to support unit servicing on HVAC equipment applications.
4. Internal Reinforcement as required for proper support and load distribution.
5. Insulated with minimum 1" duct liner insulation.
6. Integral lifting points.
7. Internal supply and return transitioning for HVAC equipment as required.

B. Gasketing: 1/4 inch thick, 1 inch wide at retrofit-adapter curb tops.

C. Minimum height 14” above existing roof curb. Extend height as needed to accommodate final filter.

D. Size of adapter curbs and required options shall be coordinated by support manufacturer with general contractor and mechanical contractor prior to fabrication.

2.07 INSPECTION, ACCESS DOORS

A. Door Fabrication: Formed and reinforced double-wall and insulated panels of same materials and thicknesses as casing.

B. Access Doors: Access to filters, dampers, coils, heaters, compressors, fans, and electrical and controls components shall be through a minimum of two ball-bearing hinges or full length stainless-steel piano hinge and two wedge-lever-type non corrosive latches operable from outside and inside (if section allows for personal entry).

C. Provide chains or hold backs brackets on all outward opening doors.

2.08 SOUND PERFORMANCE CRITERIA

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Fans shall bear AMCA-certified sound ratings seal.

2.09 ELECTRICAL

A. All electrical work shall be installed in full compliance with the National Electric Code, UL approved, and all local codes and requirements. All wiring and components inside rooftop plenums shall be weatherproof and rated for such use. All equipment shall contain a grounding conductor.

B. Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

C. Manufacturer shall provide, mount, and wire as a part of the unit assembly single point disconnect. The disconnect switch shall be furnished with a rotary or switch blade type handle that can be padlocked in the ‘off’ position. Fused type disconnect unless stated otherwise on drawing equipment schedules.

D. Unit shall be completely factory wired and shipped in sections with wiring terminated in junction boxes at required locations.

E. Minimum SCCR rating of 5000 amperes unless noted otherwise on drawing equipment schedules.

F. Unit shall include factory wired control panel compartment LED service lights.

G. Unit shall include a factory installed field wired 20 AMP, GFCI specification grade, NEMA 5-20R, located in the control center panel cabinet.

H. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.

2.10 SUPPLY FANS

A. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

B. Blowers and motors shall be dynamically balanced and mounted on vibration isolators.

C. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

D. Variable frequency drives without bypass shall be factory wired and mounted in the unit.

E. Motor shall include shaft grounding.

2.11 EXHAUST FANS

A. Exhaust dampers shall be sized for 100% relief.

B. Unit shall include direct driven, backward curved, plenum exhaust fans.

C. Fans and motors shall be dynamically balanced and mounted on vibration isolators.

D. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

E. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn handles.

F. Variable frequency drives without bypass shall be factory wired and mounted in the unit.

G. Motor shall include shaft grounding.

2.12 COOLING COILS

A. General Requirements:

1. Coils to be selected with maximum face velocity of 500 fpm; maximum fluid medium head pressure loss of 15 ft.
2. Coils shall be individually supported by a galvanized steel channel frame system to allow for coil slip in or flanged mounting. This rack shall allow any one (1) coil to be removed though the unit casing, normal to the direction of air flow, without disturbing any other coil. Coils stacked one on top of the other will not be accepted, coils shall be independently supported. Coils shall not act as structural component of unit.
3. Each coil shall include a sloped, positive-draining stainless steel condensate pan assembly. Drain pan to be constructed from minimum 18 gauge 304 stainless steel material. Coils shall set above the condensate pan for ease of removal. Condensate pan to extend the entire width of the rooftop unit with a minimum length as defined in ASHRAE 62. Each drain pan to be provided with a drain connection of sufficient size to remove condensate extended to the unit exterior for connection by others.
4. Blank off panels shall be installed to eliminate bypass airflow around the coil.
5. Supply and return connections are to be extended and sealed through the casing wall; drain and vent connections shall be terminated internally.
6. Intermediate Drain Pans: Units with stacked coils shall have an intermediate drains pan to collect condensate from each row of coils.

    a. The intermediate drain pan(s) shall be designed being of 1-1/2” deep, to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions.
    b. The intermediate pan(s) shall be constructed of the same material as the primary drain pan.
    c. The intermediate drain pan(s) shall begin at the leading face of the water-producing device with width equal to the width of the coil and extending at least 3" upstream and at least 12" downstream of the coil face.
    d. Intermediate drain pan(s) shall have drop tubes to guide condensate to the main drain pan, thus preventing flooding of lower coils that would result in moisture carryover.

B. Evaporator Coils

1. Coils shall be designed for use with R-454B refrigerant and constructed of minimum 0.024-inch-thick copper tubes with minimum 0.006-inch-thick aluminum

fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

2. Coils shall have interlaced circuitry and furnished with a factory installed expansion valves.
3. Coils shall be helium or hydrogen leak tested.

2.13 REFRIGERATION SYSTEM

A. Unit shall be factory charged with R-454B refrigerant.

B. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels. Compressors shall be isolated from the base pan with manufacturer provided vibration isolators. Provide sound jackets on all compressors

C. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control, liquid line sight glass, and suction and discharge compressor isolation valves.

D. Each capacity stage shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling and an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.

E. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, Suction line filters with isolation valves, and factory installed liquid line filter driers.

F. Unit shall include a variable speed scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity and a two-stage or one off compressor on the lag circuit.

G. Each refrigeration circuit shall be provided with an adjustable temperature sensor freeze stat which shuts down the cooling circuits when the evaporator coil tubing falls below the setpoint.

2.14 HOT-GAS REHEAT REFRIGERANT COIL:

A. Aluminum-plate fin and seamless internally grooved copper tube in steel casing or aluminum microchannel coil with equalizing-type vertical distributor.

B. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.15 CONDENSERS

A. Air-Cooled Condenser

1. Condenser fans shall be vertical discharge, axial flow, direct drive fans.
2. Condenser fan housing shall be fabricated of composite material and include an optimized orifice with inlet guide vanes. The condenser fan blade shall be serrated and aerodynamically designed for high efficiency and reduced sound levels. Single condenser fan shall not exceed a sound power level of 75 LwA.
3. Coils shall be designed for use with R-454B refrigerant.
4. Coils shall be Aluminum-plate fin and seamless internally grooved copper tube in steel casing or aluminum microchannel coil with equalizing-type vertical distributor.
5. Coils shall be designed for a minimum of 10 degree F of refrigerant sub-cooling.
6. Unit shall include factory installed, painted galvanized steel condenser coil hail guards on the face of the condenser coil.

2.16 ELECTRIC HEATING

A. Unit shall include an include electric heater consisting of electric heating coils, fuses, and a high temperature limit switch, with capacities as shown on the plans.

B. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier).

2.17 HEATING COILS

A. General Requirements

1. Coils shall be individually supported by a galvanized steel channel frame system to allow for coil slip in or flanged mounting. This rack shall allow any one coil to be removed though the unit casing, normal to the direction of air flow, without disturbing any other coil. Coils stacked one on top of the other will not be accepted, coils shall be independently supported. Coils shall not act as structural component of unit.
2. Blank off panels shall be installed to eliminate bypass airflow around the coil.
3. Supply and return connections are to be extended and sealed through the casing wall; drain and vent connections shall be terminated internally.

2.18 FILTERS

A. Unit shall include 2-inch-thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil and a 12-inch thick, cartridge final filter with a ASHRAE MERV rating of 14, in the roof adapter curb.

B. Unit shall include a Magnehelic gauge mounted in the controls compartment.

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

2.19 OUTSIDE AIR/ECONOMIZER

A. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly. Damper assembly shall be controlled by spring return enthalpy activated fully modulating with dual minimum position DDC actuator. Unit shall include outside air opening bird screen and outside air hood.

2.20 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard down turned intake hood.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit and sized to provide supply maximum 100 percent outdoor air

E. Bottom of intake shall be a minimum of 36 inches above the roof line.

2.21 CONTROL DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential. Leakage rate shall not exceed 4 cfm/sqft at 1 inch w.g. when tested in accordance with AMCA 500D.

B. Manufacturers: Subject to compliance with requirements, provide one of the following:

1. TAMCO Inc. (Model 1000)
2. Ruskin Company (Model CD50)
3. Greenheck Corporation.
4. Johnson Controls.

C. Rectangular, aluminum control damper with low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

D. Frames: Hat channel, 5 inches x 1 inch, 6063-T5 extruded aluminum with 0.125 inch minimum wall thickness. Corners reinforced with die-formed internal braces and machine staked. Hat mounting flanges on both sides.

E. Blades: Multiple blades, extruded aluminum airfoil type with maximum blade width of 6 inches, with integral full-length reinforcing tube.

F. Blade-Edge Seals: Extruded vinyl double edge design with inflatable pocket. Mechanically locked in extruded blade slots. Suitable for -50°F to 250°F operation.

G. Blade Axles: 1/2-inch diameter; plated steel hex; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

H. Bearings: Non-corrosive molded synthetic. Located at both ends of operating shaft.

I. Jamb Seals: Flexible metal compression type.

J. Control Shaft: Removable, 1/2-inch diameter

2.22 INSULATED CONTROL DAMPERS

A. Manufacturers:

1. TAMCO Inc, (9000-SC)
2. Ruskin (TED-50)
3. Johnson Controls.

B. Airfoil Low-Leakage Construction: Rectangular, aluminum damper with insulated blades and frame.

1. Application Limits:
2. Air Stream Velocity: 4000 FPM
3. Pressure Differential: 8” w.g. (variable with blade length)
4. Temperature: -40°C to 100°C.
5. Performance Characteristics: For a standard 48”x48” test section.

a. Maximum Air Leakage: Tested in conformance with AMCA 500 using Test Setup Apparatus Fig. 5.5 with an applied holding torque of 5.2 in.-lb./sq. ft.

1) AMCA Certified Performance: 4 cfm/sq. ft. at 1” w.g. differential pressure when tested between 50° and 104°F.

b. Air Pressure Drop: 0.03” w.g. maximum at 1000 fpm face velocity.

6. Construction: Mill finish.

a. Frame: 4” x 1” extruded 6063T5 aluminum channel sections formed with integral stiffeners, reinforced corner radii, edge returns, screw retainer strips, and recesses and flanges for blade jamb and edge seals.

1) Minimum Extrusion Thickness: 0.08”.
2) Insulation: Extruded polystyrene board filling open space in frame channels.

b. Blades: 6” maximum width, thermally-broken, internally insulated with high-density polyurethane CFC free foam, 6063T5 extruded aluminum with hexagonal axleway, airfoil shape with integral full-length reinforcing tube.

1) Insulation: Non-CFC, water blown, expanded polyurethane foam. Intrinsic to blade extrusion, and shielded from air stream.
2) Insulating Factor: R-2.29.
3) Temperature Index: 55.

c. Blade Axles: 7/16” hard alloy aluminum.
d. Blade Linkages: Exposed and out of stream. Non-slip design using flat-on-flat press-fit components to mate with hexagonal surfaces.

1) Linkage Hardware: Installed in frame side and constructed of aluminum and corrosion resistant, zinc and nickel plated steel, complete with cup-point trunnion screws.
2) Crank arm & Linkage Rods: Hexagonal, hard alloy 6005T5 aluminum.

e. Bearings: Celcon inner bearing fixed to blade axle and rotating within polycarbonate outer bearing inserted in damper frame.
f. Drive Rod: 12” minimum length, zinc plated steel, extendible single rod designed to provide positive blade rotation without binding.
g. Blade Edge and Jamb Seals: Silicone material formulated to maintain flexibility and resist dynamic fatigue for sealing longevity and resistance to weathering, compression set, and heat.

2.23 CONTROL DAMPER ACTUATORS

A. Type: Electronic direct-coupled designed by application on HVAC dampers.

B. Actuator Motors: Brushless DC motor controlled by an application specific integrated circuit and a microprocessor providing constant rotation rate and exact zero position.

1. Actuator Overload Protection: Electronic overload or digital rotation sensing circuitry.
2. Power supply: Nominal 24 VDC or less.

C. Actuator Coupling: Direct clamp assembly attachment over damper drive shaft or jack shaft.

D. Power-Failure/Safety Return Actuators: Equipped with internal mechanical spring return mechanism.

1. Manual Crank: Provided on actuators with more than 60 in-lb torque capacity to permit manual positioning of damper when actuator is not powered.

E. Non-Spring Return Actuators: Equipped with external manual gear release to allow manual positioning of damper when actuator is not powered.

F. Proportional Action Input Control Signals: 0 to 10 VCD with 2 to 10 VDC range, or 0 to 20 mA with 4 to 20 mA range, or pulse width modulating.

G. Minimum Design Life: 60,000 full stroke cycles.

H. Actuator Housing: Double insulated, zinc-coated metal or UL 94V-0 rated

1. Standard Applications: NEMA type 2.
2. Special Applications: NEMA 4X, explosion-proof, or weather proof as appropriate for environment.

I. Angle of Rotation: Mechanically limited to 95□.

J. Maximum Noise Level: 45 dBA.

2.24 VARIABLE FREQUENCY DRIVES

A. Air handler manufacturer shall provide and mount as a part of the unit assembly variable frequency drives for both supply and return fans. Quantity of variable frequency drives indicated on the drawings.

B. Comply with “Variable-Frequency Motor Controllers” Section 230934.

2.25 CONTROLS

A. Factory Furnished and Factory Installed Direct Digital Controls

1. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with a touchscreen controller interface. Controller shall be capable of communicating and integrating with a BACnet MS/TP or Modbus RTU network.
2. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
3. Controller shall be capable of standalone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
4. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
5. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.
6. Controller shall interface with factory furnished contractor installed high limit duct static shut down switches and factory furnished contractor installed low limit duct static shut down switches.
7. Basic Unit Controls:

a. See Drawings for unit Points List and Sequence of Operations.

2.26 ACCESSORIES

A. Smoke detector(s) sensing the return and supply air of the unit, hard wired to shut off the unit's control circuit, shall be provided by the Division 28 contractor and installed by the Division 23 contractor.

B. Unit shall include a factory-wired 115 V convenience outlet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation including openings, ductwork, mechanical utilities, and electrical utilities.

B. Be sure spaces and conditions where equipment will be installed are suitable and to code according to Authority Having Jurisdiction.

C. Rooftop Installation: Verify that equipment supplied roof adapter curbs are installed and ready to receive intended unit otherwise provide equipment matched roof adapter curbs; see Section 077200.

D. Proceed with installation after correction of unsatisfactory conditions.

3.02 INSTALLATION:

A. Install in accordance with manufacturer's written instructions.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. The unit manufacturer shall coordinate unit shipping and installation schedule with mechanical contractor. Mechanical contractor shall be responsible for the rigging, hoisting and coordination of the entire rooftop unit installation. Lifting and rigging instructions are to be provided by the unit manufacturer with the submittal drawings.

D. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

E. It is the manufacturer's responsibility to verify opening dimensions and installation methods to ensure unit sections and components can be physically installed into the designated space.

F. Testing and balancing to be performed with clean filters. Units shall not be used during construction.

G. Do not operate units for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation of the Owner's representative(s).

H. Provide insulated control dampers for outside air and exhaust/relief dampers. Provide and install non-insulated control dampers for mixing and return air systems.

I. Roof adapter curb Installation: Install in accordance with contract document provisions and manufacturer's instructions.

J. Install filter gage and static-pressure taps upstream and downstream of filters. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters. Gages and taps shall not penetrate the exterior unit casing. all gages and taps shall be accessible from inside the unit.

K. The temperature controls contractor shall install temperature controls and panel, including, control wiring, etc., required for a complete and operating control system. Electrical contractor shall make final connections to the temperature control panel after the unit is installed.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, ductwork, fittings, and specialties.

B. Install piping and ductwork adjacent to air-handling unit to allow service and maintenance.

C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements associated with roof mounted installations:

1. Install ducts to terminate at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under the entire roof curb.
3. Connect ducts to rooftop units with flexible duct connectors specified in Section 233300.

D. Connect to condensate drain pans using PVC schedule 80. Construct deep trap at connection to drain pan and route piping to and indirectly discharge at nearest roof drain. Install cleanouts at changes in direction.

E. Electrical contractor shall provide connection of power to disconnect located on unit exterior. Electrical contractor shall also provide connection of 120V/1Ph/60Hz power from the building system to the lighting and convenience outlet(s) circuit provided with the unit. Connect wiring according to Section 260519.

F. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front end interface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000-Quality Requirements for additional requirements.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect equipment installations, including connections.

C. Rooftop units shall be stored indoors in a warm, clean, dry place where unit(s) will be protected from weather, construction traffic, dirt, dust, water, and moisture. If unit(s) to be stored for more than 6 months, manufacturer’s instruction for long-term storage shall be followed.

D. Tests and Inspections:

1. Leak Test: After installation, fill with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties.
5. Replace damaged and malfunctioning controls and equipment.
6. Unit or components will be considered defective if unit or components do not pass tests and inspections.
7. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete.
4. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
5. Clean unit.
6. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations.
7. Verify that bearings are lubricated with factory-recommended lubricants.
8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
9. Comb coil fins for parallel orientation.
10. Install new, clean filters.
11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.06 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust to suit actual occupied conditions.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose

3.07 CLEANING

A. See Section 017000-Execution and Closeout Requirements for additional requirements.

B. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800-Closeout Submittals for additional submittals.

B. See Section 017900-Demonstration and Training for additional requirements.

C. Provide the services of manufacturer's field representative to conduct training.

1. Demonstrate proper operation of equipment to Owner's designated representative.
2. Train Owner's personnel on operation of system.
3. Demonstrate operation of all safety controls.

3.09 MAINTENANCE

A. See Section 017000-Execution and Closeout Requirements for additional requirements.

B. Provide the services of manufacturer's field representative train operating personnel in maintenance of units.

C. Provide service and maintenance of units for one year from Date of Substantial Completion.

END OF SECTION

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL AND ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; Latest Edition.

B. NECA 1 - Good Workmanship in Electrical Construction; Latest Edition.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); Latest Edition.

D. NFPA 70 - National Electrical Code; Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations; Latest Edition.

F. UL 1479 - Standard for Fire Tests of Penetration Firestops; Latest Edition, Including All Revisions.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions **and Division 01 Specification Sections, apply to the Division 26 and Division 28** Sections included herein.

1.3 SUMMARY

A. The work included in this section of the specifications consists of furnishing labor, equipment, supplies, and materials unless otherwise specified and performing operations necessary for the installation of **Electrical and Electrical Safety and Security Systems** work as listed in the Instruction to Bidders and as required by these specifications and shown on the drawings. These are subject to the terms and conditions of the contract. The work includes the completion of details of electrical work not mentioned or shown, which are necessary for the successful operation of electrical systems described on the drawings or required by these specifications.

B. Furnish and install all equipment described herein, and as shown on the plans, provide complete operating systems for the project. All necessary cables for connection to active equipment shall be provided for a complete working system. Unless noted otherwise, junction boxes, back-boxes, and rough-in for devices will be provided by the Division 26 subcontractor as defined in the specifications of **and Division 28**.

However, any special back-boxes required for **and Division 28** equipment shall be furnished by the **and Division 28** contactor to the Division 26 contractor for installation. Refer to **and Division 28** documents for communication system rough-in coordination items.

C. The contractor shall review all electrical drawings and the **fire alarm mechanical and plumbing** drawings. The contractor shall report all discrepancies between these drawings to the engineer before bidding for clarification. Solutions to unreported discrepancies will be determined by the engineer, with no additional compensation due to the contractor.

D. Section Includes:

1. Definitions
2. Substitutions
3. Shop Drawings
4. Payment Request Breakdown
5. Project Record Drawings
6. Operating and Maintenance Manuals
7. Basic Requirements for Utility Service
8. Project Conditions
9. Permits
10. Authority Having Jurisdiction Inspections
11. Insurance
12. Guarantee/Warranty
13. Common requirements for Electrical Installation
14. Penetration Firestopping
15. Excavation and backfill
16. Refinishing and Touchup painting
17. Cleaning and Protection
18. Equipment Furnishing by Owner
19. Interruption of Existing **Electric and Electronic Safety and Security Systems** Service
20. Building Structure Penetrations
21. Final Tests and Adjustments

1.4 DEFINITIONS

A. Basic Contract definitions are as follows:

1. Provide: The term "provide" means "to furnish and install, ready for the intended use and in complete operating condition."
2. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
3. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

4. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contracts.
5. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled and "specified" are used, it is to help the reader locate the reference>><< no limitation on location is intended.

B. Contractor: The term "Contractor" shall carry the same meaning as "Electrical Contractor" or “Division 26 Contractor” **or “Division 28 Contractor” or “Communications Contractor” or “Systems Integrator”**.

1. Or Equal: The term "Or equal" shall carry the same meaning as "approved as equal by the Engineer".
2. Shall: The term “shall” carries the same meanings as “must”.
3. Owner: All references here-in and on drawings to “Owner” shall be the same as **Rockwall ISD**.

C. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Standards Dictionary

1.5 QUALITY ASSURANCE

A. Materials, products, devices, fixtures, forms or types of construction included in this specification shall meet or exceed the requirements of National Electrical Code (NEC), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and National Electrical Manufacturers Association (NEMA), Building Industry Consulting Service, Inc. (BICSI), Electronics Industries Alliance/Telecommunications Industry Association (EIA/TIA), and the applicable local Codes.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, Article100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. **Submit certification required to provide equipment components systems packages.**

C. **Electrical and Electronic Safety and Security Systems** workers on this project shall be thoroughly knowledgeable of all applicable codes related to all electrical systems for this project. Installation shall be performed by skilled electrician tradesmen fully aware of the latest techniques, practices, and standards of the industry. Haphazard or poor installation practice as determined by the Architect or Engineer will be cause for rejection of work.

D. Good workmanship and appearance shall be required. Carefully lay out all work in advance to install in a neat and good workmanship-like manner all in accordance with recognized practices and standards of the industry, such as NECA 1 and NFPA 70.

1.6 COORDINATION

A. Drawings, specifications and documents for this project shall be taken as a whole. Prior to installation, the Contractor shall be familiar with this project by carefully reviewing and comparing all documents that pertain to this project.

B. In preparation of the contract documents, a reasonable effort has been made to provide layouts and connections based on selected and specified manufacturer's equipment. Since physical space, electrical connections, equipment arrangements and other requirements may vary according to each manufacturer, the final responsibility for connections, initial access and proper fit is the responsibility of the Contractor.

C. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
2. Sleeves through fire rated floors and walls shall be non-combustible.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

E. Prior to roughing in for electrical equipment furnished by others, verify the voltage and current characteristics and control connections of this equipment. Notify the Engineer that equipment connection requirements do not match the provisions indicated on the documents.

F. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

G. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

H. Where electrical identification markings and devices will be concealed by acoustic ceilings and similar finishes, complete installation of these items prior to ceiling tile installation.

I. The drawings are diagrammatic and indicate the approximate locations of rough-ins and may not indicate complete connection requirements. Prior to proceeding with any work or rough-ins the Contractor shall obtain all equipment rough-in requirements and information from the equipment supplier, manufacturer or from the respective trades furnishing the equipment or with Architect, to complete the installation in a neat and workmanship-like manner.

J. Scaled and calculated locations are approximate only. Before proceeding with work, carefully check and verify with building dimensions on architectural drawings, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

K. Drawings are essentially diagrammatic and indicate the general arrangement of equipment. Many offsets, bends, pull boxes, special fittings, etc. will be required which are not indicated. Carefully study drawings and premises to determine best methods, exact locations, conduit routes, building obstructions, etc., to install apparatus and equipment. Install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, maintain code required clearances, and keep openings and passageways clear.

L. Where outlet boxes are located adjacent and opposite side of the same wall, the outlet boxes shall not be placed back-to-back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have sufficient depth to maintain wall coverage in rear by masonry material.

M. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit requiring slope.
4. Connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
5. To maintain access to user-serviceable equipment.

N. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

O. Where outlet boxes are located adjacent and opposite side of the same wall, the outlet boxes shall be rated or additional material (Putty, Putty pads, UL Listed Assembly, etc.) provided to maintain the indicated fire and/or smoke rating as indicated on the Architectural documents or meeting existing ratings.

P. Where outlet boxes are not provided with a device, whether new or existing, contractor shall provide a covering faceplate. Provide a covering faceplate for every outlet box.

1.7 SUBMITTALS

A. Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Substitutions:

1. Submittal dates: For a period of up to **ten** days prior to bid date, Engineer will consider written requests from bidders, manufacturers, and suppliers for substitution of products.
2. Submission: Submit a separate request for each product, supported by descriptions, drawings and samples as appropriate, including:

    a. Comparison of the qualities of the proposed substitution with that specified. Standard features and options of the proposed substitution shall be clearly identified in the submittal.
    b. Required changes in other elements of the work because of the substitution.
    c. Availability of maintenance service, and source of replacement materials.

3. Substitution request constitutes a representation that bidder has accomplished the following:

    a. Investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
    b. Will provide the same warranties or bonds for the substitution as for the product specified.
    c. Will coordinate the installation of an accepted substitution into the Work and make such other changes as may be required to make the Work complete in all respects.
    d. Waives all claims for additional costs, under his responsibility which may subsequently become apparent.

4. Engineer Review: The Engineer will review requests for substitutions with reasonable promptness to judge the acceptability of the proposed substitution and notify bidders by addendum the decision to accept the requested substitution.
5. Late Request for Substitutions: Requests for substitution received after bidding will not be considered except in such cases where it is necessary to make a substitution due to strikes, lockouts, bankruptcy, discontinuing of a product, etc. Requests for such substitutions of materials after award of contract shall be made in writing to Engineer and shall be made within ten days of date that Contractor ascertains he cannot obtain material or equipment specified.
6. Engineer’s Acceptance: Engineer's acceptance of a substituted item applies only to the general quality and arrangement of the items substituted. Substituted items are still subject to the shop drawing review process.

C. Shop Drawings:

1. Before ordering any equipment, stamp with approval, and submit to the Engineer the electronic copy required for the contractor's and retained by the Engineer.
2. The review of shop drawings by the Architect and Engineer shall not constitute agreement regarding any deviations from the plans and specifications and shall not relieve the Contractor of responsibility for errors or omissions.
3. Shop drawings shall be electronic copy format as follows:

a. A digital copy of shop drawings (Portable Document Format (*.pdf), Revit 2023, or AutoCAD 2017 is the preferred content format).
b. Refer to each Section for specific requirements and provide submittals. Index each Section, sequenced in order of section

4. Refer to drawings for the additional equipment required that is to be submitted as part of the shop drawing submittals.
5. **Allow a minimum of fourteen calendar days for the Engineer to review the shop drawings. Time is from the receipt of drawings and documents until they are returned.**

D. Payment Request Breakdown:

1. For the purpose of establishing a schedule of values to be used for Application and Certification for Payments as defined in the General Conditions of the specifications, the items of electrical work shall be broken down per the following schedule. Each item of schedule shall contain its proper share of overhead and profit and shall be broken into a labor and material figure.
2. General Conditions

a. Electrical

1) **Electrical demolition and remodeling work**
2) **Panelboards, circuit breaker type**
3) **Surge-Protective Device, Panelboards**
4) **Conduits, 1 inch and larger**
5) **Conduits, ¾ inch**
6) **Conductors, #6 and larger**
7) **Conductors, #8 and smaller**
8) **Interior lighting fixtures**
9) **Floor Boxes and Poke Throughs**
10) **Wiring Devices**
11) **Flexible Wiring System**
12) **Service Poles**
13) **Outlet Boxes, Junction Boxes, Pull Boxes**
14) **Lighting Control System**
15) **Motor Disconnects, Starters, Controls, Etc.**
16) **Variable Frequency Drives, or Adjustable Speed Drives**

b. **Communications and Electronic Safety and Security**

1) **Fire Alarm System**

E. Project Record Documents:

1. As work progresses: Record changes or deviations from the contract drawings as follows:

a. Record location and elevation of underground conduits and direct burial wiring.

b. Record as-built changes for electrical work within the building that occur during the progress of construction and before the work is concealed. Records shall include such changes as:

1) Relocation of devices to avoid obstacles.
2) Routing of conduit from outlet to outlet.
3) Routing of conduit under floor, overhead, in walls or exposed.
4) Combining circuits into common conduit.
5) Sizes of conduits and conductors.
6) Revisions to circuit breaker quantity or arrangement in panelboards.

2. Location: The record drawings shall be maintained at the job site and be subject to review by the Owner or Engineer during the construction period. Prints for this purpose may be obtained from the Architect at cost. This record keeping requirement shall not be construed as authorization for the Contractor to make changes in the layout without definite instructions by the Architect/Engineer in each case.
3. Submission: Upon completion of the work, submit a set of drawings showing changes as noted on the record set of prints to the **Architect and Construction Manager.**

F. Operating and Maintenance Manuals:

1. Submittal: Submit to the engineer **within 15-days working days, unless indicated otherwise, of the completion of the contract, three** sets of operating and maintenance manuals including parts lists bound into hard covered manuals for the electrical equipment.**<< Each manual must include electronic data of the entire operating and maintenance manual** with folder structure and naming to match tabs in the manual. Label manuals with the local supplier's name and address. Cross out, delete, or remove information not applying to the equipment used in the project. Provide information for equipment with shop drawings.
2. Content:

a. Approved shop drawings and product data sheets alone are not acceptable maintenance material. Shipped items of equipment must include installation and maintenance sheets in the shipping package that shall also be included in the maintenance manual.

1) Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data.

b. Include special warranties.
c. All test and commissioning data of every system as called out herein, after Engineer review. Indicate the specification number and paragraph number to which each report pertains.
d. Programming: Instructions for programmable systems.
e. Hazardous Materials: Disposal Certificates. Provide design data and certificates on PDF and 8-1/2 by 11-inch paper.

1.8 PROJECT CONDITIONS

A. Exterior Environmental Conditions: Electrical systems shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Temperature ranges at the Project location as determined by the U.S. Weather Bureau.
2. Altitude: **Rockwall, TX.**

B. Interior Environmental Conditions: Electrical systems shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 72 to 75 degrees Fahrenheit (23.89 degrees Celsius), 55 degrees Fahrenheit (12.78 degrees Celsius) to ambient (unconditioned spaces).
2. Relative Humidity: 0 to 95 percent.
3. Altitude: **Rockwall, TX.**

C. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X **Stainless Steel** enclosures.

D. Interruption of Existing **Electrical or Electronic Safety and Security Systems**: Do not interrupt **Electrical or Electronic Safety and Security Systems** services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:

1. Notify Owner or Owner's Representative no fewer than 15 working days in advance of proposed interruption of service.
2. Do not proceed with interruption of services without Owner or Owner's Representative's written permission.

1.9 PERMITS

A. Obtain and pay fees for all licenses, required permits, and charges for use of outside services (i.e. inspecting agencies or delivery services) and use of property other than the site of the Work for storage of materials or other purposes.

1.10 AUTHORITY HAVING JURISDICTION INSPECTIONS

A. Secure regular inspections as required by State and local regulations. Pay charges by regulating agencies for Drawings, Specifications, review of Drawings and Specifications, and the inspections of installations.

1.11 INSURANCE

A. Procure and maintain such insurance required by **additional insurance as specified in Division 0 or 1 or Construction Manager whichever is greater**.

1.12 GUARANTEE/WARRANTY

A. The electrical system installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year unless a longer period is specified elsewhere, from **of acceptance by the owner**, except materials not furnished by the Contractor, or unless specified otherwise in sub-sections as Special Warranties.

B. LED, HID, and fluorescent lamps and drivers and ballasts shall be guaranteed for one full year from the date of **date of acceptance by the owner**, unless specified otherwise in subsections as Special Warranty.

C. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished on special equipment.

D. Special guarantee and warranty provisions, for certain work, may be set forth in their respective sections. Review each specification accordingly.

1.13 MAINTENANCE

A. Maintenance Service: During warranty period **for defective workmanship and material**.

1. Emergency Service: Provide immediate, 24-hour response.
2. Normal Service: Non-emergency service may be performed during normal working hours.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually fully match in-place adjacent surfaces to extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

C. Electrical equipment shall have factory applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion resistance test **and the additional requirements specified in the technical sections**.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

D. Right of Way: Give to piping systems installed at a required slope.

3.2 PENETRATION FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Sections.

B. General Requirements:

1. Provide penetration fire stopping that is 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. Penetration fire stopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
2. Penetrations in Fire-Resistance-Rated Walls: Provide penetration fire stopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch WG (2.49 Pa).

    a. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
    b. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

3. Penetrations in Horizontal Assemblies: Provide penetration fire stopping with ratings determined per ASTM E814or UL 1479, based on testing at a positive pressure differential of 0.01-inch WG (2.49 Pa).

    a. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
    b. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated. T-rating in subparagraph below indicates resistance to excessive thermal transmission.

c. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

4. Penetrations in Smoke Barriers: Provide penetration fire stopping with ratings determined per UL 1479.
5. Accessories: Provide components for each penetration fire stopping system that are needed to install fill materials and to maintain the required ratings. Use only those components specified by penetration fire stopping manufacturer and approved by qualified testing and inspecting agency for fire stopping indicated.

    a. Permanent forming/damming/backing materials, including the following:

        1) Slag-wool-fiber or rock-wool-fiber insulation.
        2) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
        3) Fire-rated form board.
        4) Fillers for sealants.

    b. Temporary forming materials.
    c. Substrate primers.
    d. Collars.
    e. Steel sleeves.

C. Fill Materials:

1. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
2. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
3. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
4. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
5. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
7. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
8. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
9. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
10. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and no sag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of no sag grade for both opening conditions.

D. Mixing:

1. For those products requiring mixing before application, comply with penetration fire stopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

E. Installation:

1. General: Install penetration fire stopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
2. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

3. Install fill materials for fire stopping by proven techniques to produce the following results:

a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

4. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.3 CUTTING AND PATCHING

A. Refer to Section 260505 Selective Demolition and Remodeling.

3.4 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touchup paint electrical equipment to match finish of adjacent surfaces to meet the indicated or specified safety criteria.

B. Refinish and touch up paint:

1. **Provide where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria.**
2. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
3. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
4. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
5. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
6. Paint exposed conduits to match painted surfaces.

3.5 CLEANING AND PROTECTION

A. Progress Cleaning:

1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

    a. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
    b. Do not hold waste materials for more than seven days during normal weather, or three days if the temperature is expected to rise above 80 deg F.
    c. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

        1) Use containers intended for holding waste materials of type to be stored.

    d. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

2. Site: Maintain Project site free of waste materials and debris.
3. 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.

4. Work installed: 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.

5. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
6. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
7. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Sections.
8. 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.
9. 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.
10. 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.

B. Final Cleaning:

1. Thoroughly clean electrical materials, equipment and apparatus to be free of dust, dirt, rust, and foreign materials before acceptance at Substantial Completion.
2. Clean electrical materials in conformance with manufacturer's instructions.
3. Clean panelboards, switchboards, motor controls, etc. Take special care to remove dirt, mortar, wire scraps, etc., from equipment interiors.
4. Clean accessible elements of disconnecting and protective devices of equipment, coils of dry type transformers, etc.) and vacuum clean enclosure prior to being energized.
5. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
6. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

3.6 EQUIPMENT FURNISHED BY THE OWNER

A. Contractor Requirement:

1. Inspect in presence of the Owner's Representative, and report in writing, any damage.
2. Assume responsibility for receiving, storing, protecting, installing, and connecting owner furnished equipment.
3. List of Owner furnished equipment **and equipment as indicated on the drawings**.

3.7 INTERRUPTION OF EXISTING ELECTRIC SERVICE

A. The existing building will be in use during construction. Schedule and carry out the Work in such a manner as to cause the Owner a minimum of inconvenience due to service interruption. Temporary services (feeder, branch circuit and signal systems) shall be installed if one area or phase of construction disrupts service to another area of the building(s) or if equipment, conduits, or feeders have to be relocated to allow construction to progress. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled in advance with the Owner's site representative. All interruptions shall be conducted and shall be limited to after-hours **(9:00 pm – 6:00 am and weekends**, or as directed by the Owner. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning automatically controlled equipment to the same operating condition which existed prior to the interruption.

B. Notify the Owner a minimum of **15 calendar days** prior to service interruption.

3.8 BUILDING STRUCTURE PENETRATIONS

A. Where existing or temporary raceway systems are being demolished, which leave openings in the existing building structure, the building structure shall be patched to match the existing construction and maintain the existing building fire ratings.

3.9 FINAL TESTS AND ADJUSTMENTS

A. Provide personnel for initial start-up and operation of the electrical equipment and for a trial run of the equipment to demonstrate that the equipment and associated systems are properly installed and operating as intended before the date of substantial completion.

B. Upon completion, subject the work to such tests as are required under industry standards and/or specified herein. Acceptance of the work by Owner shall be contingent upon satisfactory completion of these tests.

C. Subject the work to a careful and thorough visual inspection to detect erroneous or loose connections, damaged components, presence of foreign objects or materials, poor workmanship, incorrect ratings of overcurrent protective devices, or other abnormal conditions.

D. Perform tests to demonstrate proper functioning of lighting equipment, controls, proper rotation, etc. Proper operation of permanently connected meters and metering equipment shall be demonstrated, and the accuracy thereof established to a reasonable degree.

E. Overcurrent protective devices shall be properly coordinated, and as the equipment is put into service, necessary final adjustments shall be made to equipment within the scope of work under this contract to make the electrical system operative throughout.

F. Operating conditions encountered requiring abnormal or unsafe settings of protective devices must be brought to the attention of the Engineer immediately. Tests shall be recorded and the reports submitted to the Engineer.

G. Perform specific testing as may be required to comply with installation requirements of the National Fire Protection Association (NFPA). Reporting of these tests shall be submitted to the Engineer and to Authority Having Jurisdiction as defined by the code.

3.10 INSTRUCTION OF OWNERS EMPLOYEES

A. Provide the services of competent instructors, who will give full instructions on the care, adjustment, and operation of parts of the electrical system and equipment to the Owner's employees who are to have charge of the equipment.

B. Each instructor shall be thoroughly familiar with parts of the installation on which he is to give instructions and shall have full knowledge of the operating theory and practical operation-maintenance work. Factory trained instructors shall be employed wherever they are available.

C. Instructions shall be given during the regular work week after the building has been accepted and turned over to the Owner for regular operation. In addition to the time indicated in other **Division 26 and Division 28 sections, provide one man-day (8 hours)** of instructions for general systems.

D. The instructions shall be given within three months after the work has been accepted and turned over to the Owner at a time mutually agreed on with the Owner.

E. Notify the Engineer in writing when such instruction has been completed.

END OF SECTION

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SECTION 260505
SELECTIVE DEMOLITION AND REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition and remodeling

1.2 RELATED REQUIREMENTS

A. **Section 017000 - Execution and Closeout Requirements: Additional requirements for alterations work.**

B. **Section 028400 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment and materials containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to those containing PCBs and mercury.**

1.3 SUBMITTALS

A. **See Section 013000 - Administrative Requirements, for submittal procedures.**

B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

C. Disposal Certificates: For PCB-impregnated ballasts, fluorescent lamps, HID lamps, and other hazardous materials. Provide copies of certificates to Owner and Engineer at the completion of the project

1.4 DEMOLITION RESPONSIBILITIES

A. Re-support or Removal: For electrical equipment to be demolished; remove accessible wiring including conduit, junction boxes, hangers and supports for feeders and conduits, remove branch circuits from panelboards to electrical devices such as light fixtures, receptacles, switches, floor outlets, specific use outlets, and equipment, etc. Existing conduit, boxes, cable, etc. which are presently being supported from existing ceilings or walls to be removed, shall be temporarily supported to building structure then reinstalled in new ceilings or walls.

B. Patching: Where conduits are stubbed out of a surface not being removed for new construction, such as a floor slab or poured concrete column or wall, these conduits must be cut back to a point where patching can adequately be performed.

C. Coordinate demolition work with the Owner. Should questions arise regarding the removal of a conduit and/or wiring, (i.e. Is it energized? Does it serve a load in an area

not be remodeled?), confer with the Owner before such wiring or conduit is actually demolished.

D. Salvaged, Reused and Reinstalled equipment and devices: Carefully disconnect and remove items to be salvaged, reused or reinstalled. Any questions regarding the quality and reusability of an item shall be brought to the attention of the Engineer/Architect prior to removal. Items shall be properly stored in a manner causing no additional damage to the item. Prior to reinstalling, clean and test item. Upon completion, the item shall be in equivalent condition as prior to its removal. Items damaged due to improper handling and storage by the Contractor shall be replaced with new items of the same type and quality as the original item. Reinstalled light fixtures shall be re-lamped with new lamps. Non-functioning ballasts shall be replaced with new ballasts. Lamps and ballasts shall be guaranteed as new items. Salvaged items to be turned over to the Owner as described in this specification section and on plans.

E. Demolition equipment and devices: Existing equipment, devices, and light fixtures not indicated for reuse or salvage shall become the property of this Contractor, unless indicated otherwise, and disposed of properly.

1. Light fixtures scheduled for removal on this project may contain PCB impregnated ballasts. Remove PCB ballasts from light fixtures and place ballasts in hazardous waste disposal containers. Properly dispose of the ballasts with a registered hazardous materials disposal contractor.
2. Fluorescent and HID lamps removed from light fixtures shall be placed in containers, and properly disposed of with a registered disposal contractor.

F. Low Voltage Systems: Existing communication systems including **fire alarm** must remain intact and operating. Should portions of systems require relocation due to demolition, coordinate this move with the Owner before disconnection. Should portions of the fire alarm system require removal or relocation, contact the fire alarm monitoring company and the Owner before initiating any work on the system.

G. **Contractor** shall be responsible for rework of the following systems: **fire alarm.** Contractor is responsible for rework of all other systems.

H. Raceway System Rework: Rework the existing raceway system such that upon completion of the remodeling, no junction boxes are in inaccessible locations. This includes junction boxes that may be rendered inaccessible due to new piping or ductwork installation. Coordinate with other trades in this effort. Provide additional conduit and connections as required.

1.5 EXISTING CONDITIONS

A. Drawing Representations: Conduits, lights, circuiting, devices, speakers, etc., shown on the drawings as existing are based on existing plans and may not be installed as originally shown**.**

B. Verify the accuracy of the “Existing Conditions” as shown on the drawings as the demolition work progresses. Perform modifications and additions as necessary to correct for these hidden conditions and allow for the completion of the new work.

C. Repair of Existing Work: Perform repair of existing work **demolition, and modification of existing electrical distribution systems** as follows:

1. Workmanship; Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved
2. Existing Concealed Wiring to be Removed: Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings
3. Removal of Existing Electrical Distribution System: Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, **back to equipment's source** as indicated

D. Continuation of Service: Maintain continuity of existing equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring which are to remain but were disturbed during demolition back to original condition.

1.6 CUTTING AND PATCHING

A. Provide cutting and patching in conformance the following requirements for and limitations on cutting and patching of construction elements:

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity
2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, or that result in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner and Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner before partially or completely disabling system.
2. Notify local fire service.
3. Make notifications at least 24 hours in advance.
4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone and Communications System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:

1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to the source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if the conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving use equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finish damaged during demolition and extension work.

J. Maintain access to existing active electrical installations. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. **See Section 017419 - Construction Waste Management and Disposal for additional requirements.**

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering, and chopping. Cut holes and slots neatly to minimum size needed, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following the performance of other work. Patch with durable seams that are as invisible as practical. Provide materials and follow installation requirements specified in other Sections, where applicable

G. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

1. Clean piping, conduit, and similar features before applying paint or other finishing materials.
2. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where removed walls or partitions extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace them with new materials, if necessary, to achieve uniform color and appearance.
4. Where patching occurs in a painted surface, prepare the substrate apply primer and intermediate paint coats proper for substrate over the patch, and apply final paint coat over entire unbroken surface holding the patch. Provide more coats until the patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components in a manner that restores the enclosure to a weathertight condition and ensures thermal and moisture integrity of the building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION

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SECTION 260509
FIELD QUALITY ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260500 “Common Work Results for Electrical, Communications, and Electronic Safety and Security.”

1.2 SUMMARY

A. **Section includes services of an Independent Testing Agency to perform Acceptance Testing.**

1.3 DEFINITIONS

A. NETA – International Electrical Testing Association Inc.

B. NETA ATS – International Electrical Testing Association Inc. Acceptance Testing Specifications (most current Edition).

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 POWER AND DISTRIBUTION EQUIPMENT

A. Sections Include:

1. **260519 Low-Voltage Electrical Power Conductors and Cables**
2. **260526 Grounding and Bonding for Electrical Systems**
3. **262816.13 Enclosed Circuit Breakers**
4. **262816.16 Enclosed Switches**

B. Tests and Inspections:

1. Perform tests and inspections in accordance with NETA ATS. Optional tests are not required.
2. Perform thermographic survey after substantial completion and after electrical loads have been applied to the system.

C. Test Labeling:

1. After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

D. Reports:

1. Prepare test and inspection reports including a certified report that identifies test components. Include notation of poor workmanship deficiencies detected **and remedial action taken, and observations after remedial action**.

3.2 LIGHTING CONTROLS

A. Section Included:

1. **Section 260923 Lighting Control Devices**

B. Perform the following tests and inspections **with the assistance of factory-authorized service representative**:

1. Test continuity of circuits.
2. Operational Test: Set and operate time switches, sensors, and controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

    a. Test dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

3. Test Emergency Power transfer functions.

3.3 SECTION 262726 “WIRING DEVICES”

A. Perform the following test and inspections **with the assistance of a factory-authorized service representative**:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade **convenience outlets in patient-care areas hospital-grade convenience outlets** for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

3.4 LIGHTING

A. Sections Included:

1. **Section 265100 Interior Lighting**

B. Interior Lighting – Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION

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SECTION 260510
TEMPORARY CONSTRUCTION LIGHTING AND POWER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 260500 – Common Work Results for Electrical, Communications, and Electronic Safety and Security

1.2 SUMMARY

A. This Section includes requirements for temporary construction lighting and power facilities.

B. Requirements include:

1. Use charges.
2. **Construction of temporary lighting and power supply from Owner's existing power system.**

1.3 USE CHARGES

A. **Cost of use charges for temporary lighting and power shall be paid for by the General Contractor or Owner.**

1.4 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Contractor shall assume responsibility for operation, maintenance, and protection of each permanent service during construction before acceptance by Owner.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Arrange with **Owner** for installation of temporary service.

B. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

C. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

D. Coordinate installation of overhead or underground electric power service with the Construction Manager.

E. Connect temporary service to Owner's existing power source, as directed by Owner.

3.2 TEMPORARY UTILITY INSTALLATION

A. Electric Power Service: Provide electric power service and distribution system of size, capacity and power characteristics **required for construction operations as directed by the Construction Manager**.

B. Service Equipment:

1. Provide temporary service feeders to service equipment.
2. Provide metering/CT cabinet if required by the project.
3. Provide service panelboard or switchboard as required by the project.

C. Receptacles: Provide one 120-volt, 20 amp circuit per 200 square feet of new construction area from temporary panels with outlets located so that no extension cord in use need be longer than 100 feet.

D. Power Outlet: Provide one 20 amp, 208-volt, 3 phase power outlet for every 2,500 square feet of new construction area. Each contractor shall pay all costs and take all arrangements for any additional heavy duty (208-volt) power outlets or circuits required to perform their work or operate their tools and equipment. Each individual contractor shall pay for and make provisions for welding as required.

E. Interior Lighting: Provide temporary lighting throughout the new building construction area at a minimum of fifteen-foot candles.

F. Construction Trailers: Provide connection to the construction trailers as directed by the Construction Manager.

3.3 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION

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SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Nonmetallic-sheathed cable.

C. Underground feeder and branch-circuit cable.

D. Service entrance cable.

E. Armored cable.

F. Metal-clad cable.

G. Power and control tray cable.

H. Circuit integrity cable

I. Variable-frequency drive cable.

J. Photovoltaic wire.

K. Manufactured wiring systems.

L. Wiring connectors.

M. Electrical tape.

N. Heat shrink tubing.

O. Oxide inhibiting compound.

P. Wire pulling lubricant.

Q. Cable ties.

R. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire, Latest Edition.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, Latest Edition.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes, with Editorial Revision, Latest Edition.

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation, Latest Edition.

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers, Latest Edition.

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation, Latest Edition.

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape, Latest Edition.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes, Latest Edition.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials, Latest Edition.

J. FM 3971 - Fire Protective Coatings and Wraps for Grouped Cables, Latest Edition.

K. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation), Latest Edition.

L. IEEE 383 - IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities, Latest Edition.

M. NECA 1 - Standard for Good Workmanship in Electrical Construction, Latest Edition.

N. NECA 104 - Standard for Installing Aluminum Building Wire and Cable, Latest Edition.

O. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable, Latest Edition.

P. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF) , Latest Edition.

Q. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy, Latest Edition.

R. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems, Latest Edition.

S. NFPA 70 - National Electrical Code Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. NFPA 79 - Electrical Standard for Industrial Machinery, Latest Edition.

U. UL 4 - Armored Cable Latest Edition, Including All Revisions.

V. UL 44 - Thermoset-Insulated Wires and Cables Latest Edition, Including All Revisions.

W. UL 83 - Thermoplastic-Insulated Wires and Cables Latest Edition, Including All Revisions.

X. UL 183 - Manufactured Wiring Systems Latest Edition, Including All Revisions.

Y. UL 267 - Outline of Investigation for Wire-Pulling Compounds Latest Edition, Including All Revisions.

Z. UL 486A-486B - Wire Connectors Latest Edition, Including All Revisions.

AA. UL 486C - Splicing Wire Connectors Latest Edition, Including All Revisions.

BB. UL 486D - Sealed Wire Connector Systems Latest Edition, Including All Revisions.

CC. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Latest Edition, Including All Revisions.

DD. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Latest Edition, Including All Revisions.

EE. UL 719 - Nonmetallic-Sheathed Cables Latest Edition, Including All Revisions.

FF. UL 854 - Service-Entrance Cables Latest Edition, Including All Revisions.

GG. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members Latest Edition, Including All Revisions.

HH. UL 1569 - Metal-Clad Cables Latest Edition, Including All Revisions.

II. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable Latest Edition, Including All Revisions.

JJ. UL 4703 - Standard for Photovoltaic Wire Latest Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Refer to Division 01 for administrative requirements and submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

E. Wire Pulling Lubricant: Certification of compatibility with conductors/cables.

F. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

G. Field Quality Control Test Reports.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 01 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Provide wires and cables in accordance with applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

1. Exceptions:

a. Use manufactured wiring systems for branch circuits where concealed under raised floors or where concealed above accessible ceilings for lighting.
b. Use power and control tray cable for installation in cable tray.
c. Use variable-frequency drive cable for connection between variable-frequency motor controllers and associated motors.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to view.
b. Where exposed to damage.

E. Service entrance cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For overhead service drop, installed in raceway to service head.
b. For underground service entrance, installed in raceway.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to damage.

F. Armored cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

1) Maximum Length: 6 feet.

b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from first accessible junction box concealed in accessible ceiling space to panelboard.

c. For general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities, when provided with additional insulated grounding conductor for redundant grounding.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to view.
b. Where exposed to damage.
c. For damp, wet, or corrosive locations.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

1) Exception: Provide single conductor building wire in raceway for circuit homerun from first accessible junction box concealed in accessible ceiling space to panelboard.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to damage.
b. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.
c. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.
d. For patient care areas of health care facilities requiring redundant grounding.

H. Manufactured wiring systems are permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For branch circuits where concealed under raised floors, where concealed above accessible ceilings for lighting, and in open ceiling areas for lighting.
b. For general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities, when provided with additional insulated grounding conductor for redundant grounding.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to damage.
b. For damp, wet, or corrosive locations.
c. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with the requirements of NFPA 70 and RoHS compliance.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Comply with FS A-A-59544 where applicable.

G. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83 and UL 719.

H. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

I. Conductors for Grounding and Bonding: Also comply with Section 260526.

J. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

K. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

L. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

M. Insulation: Rated 75-degree C minimum, unless indicated otherwise.

1. Where equipment or devices require 90-degree Centigrade (C) insulated conductors, provide only conductors with 90-degree C insulation or better, e.g. 100 percent rated circuit breakers.
2. Where ambient temperature exceeds 86-degree F, provide 90-degree C insulation or better.

N. Conductor Material:

1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.

    a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and Engineer, only for the following:

        1) Services: Copper conductors size 1/0 AWG and larger.
        2) Feeders: Copper conductors size 1/0 AWG and larger.

    b. Aluminum conductors shall not be used on mechanical equipment connections.
    c. Where aluminum conductors are substituted for copper, comply with the following:

        1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
        2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.

3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated. If substituting, review the conductor sizing to ensure it is appropriate for the load. Unless indicated otherwise, conductors are sized based on copper.

O. Minimum Conductor Size:

1. Branch Circuits: 12 AWG Copper.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

Q. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:

1) Phase A: Black.
2) Phase B (High-Leg): Orange.
3) Phase C: Blue.
4) Neutral/Grounded: White.

d. 240/120 V, 1 Phase, 3 Wire System:

1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.

e. Equipment Ground, All Systems: Green.
f. Isolated Ground, All Systems: Green with yellow stripe.
g. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
h. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Building Wire:

a. Alpha Wire Company.
b. American Bare Conductor.
c. Belden Inc.
d. Cerro Wire LLC
e. Encore Wire Corporation
f. General Cable Technologies Corporation
g. Okonite Company.
h. Service Wire Co
i. Southwire Company
j. WESCO.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Solid or stranded.
b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.
3. Low Leakage Type: Cross-linked Polyethylene Insulation, XHHW-2, VW1, wire in accordance with UL requirements. 600 volts with conductor temperatures of 90^0C. Wire must be designed to reduce capacitive and resistive leakage to a dielectric constant 3.5. <55uA leakage current at 120-volt over 100 feet. Minimum insulation wall thickness: 40-mil.

2.4 ARMORED CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid pr Stranded
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.

1. Provide additional full-size integral insulated equipment grounding conductor for redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities.

G. Armor: Steel, interlocked tape.

2.5 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc
2. Encore Wire Corporation
3. Service Wire Co
4. Southwire Company

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid or stranded.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated.

G. Provide dedicated neutral conductor for each phase conductor on single phase circuits.

H. Grounding: Full-size integral equipment grounding conductor.

1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

2.6 POWER AND CONTROL TRAY CABLE

A. Manufacturers:

1. Encore Wire Corporation
2. General Cable Technologies Corporation
3. Okonite
4. Service Wire Co
5. Southwire Company

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Where exposed run cable is indicated between cable tray and utilization equipment in qualifying industrial establishments as determined by authorities having jurisdiction, provide tray cable marked as Type TC-ER in accordance with NFPA 70.

D. Conductor Stranding: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type XHHW or XHHW-2.

G. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.7 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:

1. Service Wire Co; ServiceDrive
2. Southwire

B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 1000 V.

E. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.

F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

G. Provide metallic shielding.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.8 PHOTOVOLTAIC WIRE

A. Manufacturers:

1. Encore Wire Corporation; SmartSun XLPE Insulation:
2. Service Wire Co; ServiceSolar:

B. Description: Sunlight-resistant, single-conductor, insulated photovoltaic wire listed and labeled as complying with UL 4703; specifically designed for interconnection wiring of photovoltaic power systems in accordance with NFPA 70.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: As required for photovoltaic power system voltage.

2.9 CIRCUIT INTEGRITY CABLE

A. Manufacturers:

1. KME copper:
2. Omnicable:
3. Pentair Pyrotenax:
4. Prysmian Group:
5. Radix

B. Description: Two-hour UL2196 rated in both vertical and horizontal configurations, in EMT or Phenolic Conduit Type XW. Low Smoke Zero Halogen (LSZH) Design. For use to comply with NEC 517, 695, 700, 708, and 660. Type RHH/RHW-2 cable UL 44**<< or Type MC>>**. Mineral Insulated, Type MI, may also be used.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.10 MANUFACTURED WIRING SYSTEMS

A. Manufacturers:

1. AFC Cable Systems Inc
2. D&P Custom Lights & Wiring Systems, Inc
3. RELOC Wiring Solutions, a brand of Acuity Brands, Inc
4. Wiremold, a brand of Legrand North America, Inc

B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.

C. Provide components necessary to transition between manufactured wiring system and other wiring methods.

D. Branch Circuit Cables:

1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
2. Insulation Voltage Rating: 600 V.
3. Insulation: Type THHN.
4. Provide dedicated neutral conductor for each phase conductor where indicated or required.
5. Grounding: Full-size integral equipment grounding conductor.
    a. Provide additional isolated/insulated grounding conductor where indicated or required.
    b. Provide redundant grounding, suitable for general purpose, non-essential electrical systems in non-hazardous patient care areas of health care facilities where indicated or required.
6. Armor: Steel, interlocked tape.

E. Connectors: Keyed and color-coded to prevent interconnection of different voltages.

F. Fixture Leads: Type TFN insulation.

2.11 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
3. Connectors for Aluminum Conductors: Use compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
5. Aluminum Conductors: Use compression connectors for all connections.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:

a. 3M
b. Ideal Industries, Inc
c. NSI Industries LLC

H. Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufacturers:

a. Burndy LLC:
b. Ilsco
c. Thomas & Betts Corporation

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

1. Manufacturers:

a. Burndy LLC
b. Ilsco

c. Thomas & Betts Corporation:

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

1. Manufacturers:

a. Burndy LLC
b. Ilsco
c. Thomas & Betts Corporation

2.12 ACCESSORIES

A. Electrical Tape:

1. Manufacturers:

a. 3M
b. Plymouth Rubber Europa:

2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil (0.18 mm); suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

1. Manufacturers:

a. 3M
b. Burndy LLC

c. Thomas & Betts Corporation

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

1. Manufacturers:

a. Burndy LLC:
b. Ideal Industries, Inc:
c. Ilsco:

D. Wire Pulling Lubricant:

1. Manufacturers:

a. 3M:
b. American Polywater Corporation:
c. Ideal Industries, Inc:

2. Listed and labeled as complying with UL 267.
3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.
5. Products:

a. American Polywater Corporation; Polywater J Cable Pulling Lubricant:
b. American Polywater Corporation; Polywater LZ Cable Pulling Lubricant:

E. Cable Ties: Material and tensile strength rating suitable for application.

1. Manufacturers:

a. Burndy LLC:

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:

a. Menzies Metal Products; Electrical Roof Stack and Cap:
b. Menzies Metal Products; Electrical Retro Box:

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built:

H. Fire-Protective Coating for Electrical Conductors and Cables: Field-applied, intumescent or ablative coating designed to prevent ignition and propagation of fire along thermoplastic-insulated conductors and cables.

1. Pass flammability tests of one of the following:

a. ASTM E84, Class A; maximum flame spread index of 25.
b. FM 3971.
c. IEEE 383.

2. Products:

a. Vimasco Corporation; CharCoat CC Cable Coating

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:

    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required to account for ampacity derating.
    c. Size raceways, boxes, etc. to accommodate conductors.
    d. Common Neutrals: Shared neutrals are prohibited.

8. Provide oversized neutral/grounded conductors where indicated and as specified below.

    a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install armored cable (Type AC) in accordance with NECA 120.

F. Install metal-clad cable (Type MC) in accordance with NECA 120.

G. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
5. **Submit a cable pulling plan, to include methods, maximum cable pulling tension, jam ratio, and cable sidewall bearing pressure (SWBP) when:**

    a. Conductors are #1AWG or larger, and;
    b. Feeder lengths are greater than 100 feet, or;
    c. There are more than two 90 degree bends, or;
    d. Conductors are installed underground

6. **Maximum Cable Pulling Tension as follows:**

Conductor Size	Circular Mils (cmil)	3-Conductor Max Tension (lbs)	4-Conductor Max Tension (lbs)
#1 AWG	83,690	2,009	2,143

1/0 AWG	105,500	2,532	2,701
2/0 AWG	133,100	3,194	3,407
3/0 AWG	167,800	4,027	4,296
4/0 AWG	211,600	5,078	5,417
250 kcmil	250,000	6,000	6,400
300 kcmil	300,000	7,200	7,680
350 kcmil	350,000	8,400	8,960
500 kcmil	500,000	12,000	12,800
750 kcmil	750,000	18,000	19,200

7. Maximum SWBP is 300 lbs/ft. Increase bend radius or decrease pulling tension when SWBP exceeds 300 lbs/ft.

8. Provide tension monitoring for all pulls of conductors #1AWG, or larger, exceeding 100 feet or with more than two 90-degree bends.

a. Tension shall not exceed

1) Maximum cable pulling tension, or cable pulling plan calculated tension.

2) Manufacturer's maximum pulling eye tension, or 10,000 pounds, whichever is less. Submit pulling eye information with cable pulling plan.

3) Manufacturer's rated basket grip tension. Submit basket grip information with cable pulling plan.

H. Exposed Cable Installation (only where specifically permitted):

1. Route cables parallel or perpendicular to building structural members and surfaces.
2. Protect cables from physical damage.

I. Direct Burial Cable Installation:

1. Install cable with minimum cover of 36 inches unless otherwise indicated or required.
2. Protect cables from damage in accordance with NFPA 70.
3. Provide underground warning tape in accordance with Section 260553 along entire cable length.

J. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

K. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

L. Terminate cables using suitable fittings.

1. Armored Cable (Type AC):

a. Use listed fittings and anti-short, insulating bushings.
b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

2. Metal-Clad Cable (Type MC):

a. Use listed fittings.
b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

M. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

N. Install conductors with a minimum of 12 inches of slack at each outlet.

O. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

P. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

Q. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

R. Where allowed by section 517 of the NEC and patient care areas, MC cable may be used and shall be healthcare facilities cable (HCF).

S. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

T. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

U. Insulate ends of spare conductors using vinyl insulating electrical tape.

V. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape for a minimum of 6 inches at each termination and at each location conductors are accessible. To prevent unwinding, apply last two turns with no tension. Avoid factory cable markings when applying tape.

W. Identify conductors and cables in accordance with Section 260553.

X. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

Y. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

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SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Chemically-enhanced ground electrodes.

G. Ground plate electrodes.

H. Ground enhancement material.

I. Ground access wells.

J. Pre-fabricated signal reference grids.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. **ANSI/TIA 607, Latest Edition**

B. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System, Latest Edition.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction, Latest Edition.

D. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings, Latest Edition.

E. NETA ATS - Standard For Acceptance Testing Specifications for Electrical Power Equipment and Systems, Latest Edition.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. **NFPA 99 - Health Care Facilities Code, Latest Edition, with Amendment.**

H. NFPA 780 - Standard for the Installation of Lightning Protection Systems, Latest Edition.

I. UL 467 - Grounding and Bonding Equipment Latest Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. **See Section 013000 - Administrative Requirements for submittals procedures.**

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:

1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products per manufacturer's instructions.

1.8 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

    a. Provide continuous grounding electrode conductors without splice or joint.
    b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipes:

a. Provide connection to underground metal domestic and fire protection (where present) water service pipes that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
b. Provide bonding jumpers around insulating joints/pipes as required to make pipe electrically continuous.
c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:

   a. Provide connection to metal in-ground support structure that is in direct contact with earth per NFPA 70.

4. Concrete-Encased Electrode:

   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth per NFPA 70.

5. Ground Ring:

   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
   b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
   c. Provide connection from ground ring conductor to:

      1) Perimeter columns of metal building frame.
      2) Ground rod electrodes located not more than twice the length of the ground rod electrodes apart.

6. Ground Rod Electrodes:

   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrodes at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

7. Provide additional ground electrodes as required to achieve specified grounding electrode system resistance.
8. Ground Bar: Provide copper ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

a. Ground Bar Size:

1) Electrical Ground Busbar (EGB): 1/4 by 2 by 24 inches unless otherwise indicated or required.
2) Telecommunications Main Ground Busbar (TMGB): 1/4 by 4 by 18 inches unless otherwise indicated or required.
3) Telecommunications Ground Busbar (TGB): 1/4 by 2 by 18 inches unless otherwise indicated or required.

b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

B. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

C. Grounding for Separate Building or Structure Supplied by Feeders or Branch Circuits:

1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

D. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:

a. Transformers (except autotransformers such as buck-boost transformers).
b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
c. Generators, when neutral is switched in the transfer switch.

2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.

3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

E. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and per NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally per NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems per NFPA 70. This includes, but is not limited to:

    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
    c. Metal process piping.

8. Provide bonding for metal building frame.
9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
10. Provide bonding and equipment grounding for pools and fountains and associated equipment per NFPA 70.
11. Provide redundant grounding and bonding for patient care areas of health care facilities per NFPA 70 and NFPA 99.

F. Isolated Ground System:

1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

a. Exceptions:

1) Use mechanical connectors for connections to electrodes at ground access wells.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

a. Exceptions:

1) Use exothermic welded connections for connections to metal building frame.

4. Manufacturers - Mechanical and Compression Connectors:

    a. allG Fabrication
    b. Burndy LLC
    c. Harger Lightning & Grounding
    d. nVent ERICO
    e. Thomas & Betts Corporation
    f. Substitutions: See Section 016000 - Product Requirements.

5. Manufacturers - Exothermic Welded Connections:

    a. Burndy LLC
    b. nVent ERICO; Cadweld
    c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:

    a. allG Fabrication
    b. Harger Lightning & Grounding
    c. nVent ERICO
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:

    a. allG Fabrication
    b. Galvan Industries, Inc
    c. Harger Lightning & Grounding
    d. nVent ERICO

F. Chemically-Enhanced Ground Electrodes:

1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
2. Length: 10 feet.
3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.

4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
5. Manufacturers:

    a. allG Fabrication
    b. Harger Lightning & Grounding
    c. nVent ERICO
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

G. Ground Plate Electrodes:

1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
3. Manufacturers:

    a. allG Fabrication
    b. Harger Lightning & Grounding
    c. nVent ERICO
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

H. Ground Enhancement Material:

1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Resistivity: Not more than 20 ohm-cm in final installed form.
3. Manufacturers:

    a. Harger Lightning & Grounding
    b. nVent ERICO; GEM
    c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

I. Ground Access Wells:

1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.

    a. Round Wells: Not less than 8 inches in diameter.
    b. Rectangular Wells: Not less than 12 by 12 inches.

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:

    a. allG Fabrication
    b. Harger Lightning & Grounding
    c. nVent ERICO
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

J. Pre-Fabricated Signal Reference Grids:

1. Description: Factory pre-fabricated grid manufactured from 2 inch wide, 26 gauge, flat copper strips spaced on 24 inch centers, factory-welded at each crossover.
2. Low Impedance Risers: Factory fabricated 2 inch wide, 26 gauge, flat copper strips designed for connecting equipment enclosures to pre-fabricated signal reference grid.
3. Manufacturers:

    a. allG Fabrication
    b. Erico International Corporation
    c. Harger Lightning & Grounding
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems.

B. Make ground connection at main service equipment and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lag connection to plugged tee.

C. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection. Install products per manufacturer's instructions.

D. Perform work per NFPA 70 and NECA 1 (general workmanship).

E. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches deep per NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
3. If this resistance cannot be obtained with a single rod, add rods. Spacing for additional rods must be a minimum of 10 feet.

F. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

G. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected per manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturers' recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

H. Identify grounding and bonding system components per Section 260553.

3.3 GROUNDING SYSTEM RESISTANCE:

A. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

B. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

C. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

3.4 FIELD QUALITY CONTROL

A. Perform inspections and tests listed in NETA ATS, Section 7.13.

B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

D. Provide report of testing and findings.

END OF SECTION

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SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, Latest Edition.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, Latest Edition.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel, Latest Edition.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position, Latest Edition.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials, Latest Edition.

F. MFMA-4 - Metal Framing Standards Publication, Latest Edition.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction, Latest Edition.

H. NFPA 70 - National Electrical Code, Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code, Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured**<<; see Section 033000>>**.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products per manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.

    a. NFPA 70.
    b. Requirements of authorities having jurisdiction.

2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select per manufacturer's application criteria as required for load to be supported with minimum safety factor of 3 to 1. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.

    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated per ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication per ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Manufacturers:

    a. ABB
    b. Eaton Corporation
    c. Emerson Electric Co; O-Z/Gedney
    d. HoldRite, a brand of Reliance Worldwide Corporation
    e. MonoSystems, Inc.
    f. nVent; Caddy

2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
3. Conduit Clamps: Bolted type unless otherwise indicated.
4. Products:

    a. Gripple, Inc; Universal Bracket
    b. Gripple, Inc; Fast Trak
    c. Gripple, Inc; Universal Clamp (Threaded)
    d. Gripple, Inc; Low Profile Bracket Kits

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

1. Manufacturers:

    a. ABB
    b. Eaton Corporation
    c. Emerson Electric Co; O-Z/Gedney
    d. HoldRite, a brand of Reliance Worldwide Corporation
    e. nVent; Caddy

D. Metal Channel/Strut Framing Systems:

1. Manufacturers:

    a. ABB
    b. Atkore International Inc; Unistrut
    c. Custom Strut and Roll Forming, LLC
    d. Eaton Corporation
    e. Elgen Manufacturing Company, Inc
    f. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.

2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.

E. Fiberglass Channel/Strut Framing Systems:

1. Manufacturers:

    a. Atkore International Inc; Unistrut
    b. Champion Fiberglass
    c. Eaton Corporation
    d. Enduro Composites

2. Description: Factory-fabricated, continuous-slot, fiberglass channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Flammability: Fire retardant with NFPA 101, Class A flame spread index, maximum of 25, when tested per ASTM E84; self extinguishing per ASTM D635.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

a. Equipment Supports: 1/2-inch (13 mm) diameter.
b. Busway Supports: 1/2-inch (13 mm) diameter.
c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch (10 mm) diameter.
e. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
f. Outlet Boxes: 1/4-inch (6 mm) diameter.
g. Luminaires: 1/4-inch (6 mm) diameter.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:

a. Atkore International Inc; Unistrut
b. Eaton Corporation
c. Green Link, Inc
d. nVent; Caddy
e. PHP Systems/Design

2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

H. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:

a. Dewalt
b. Hilti, Inc
c. ITW Red Head, a division of Illinois Tool Works, Inc
d. Simpson Strong-Tie Company Inc

2. Manufacturers - Powder-Actuated Fastening Systems:

a. Dewalt
b. Hilti, Inc
c. ITW Ramset, a division of Illinois Tool Works, Inc
d. Simpson Strong-Tie Company Inc

3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products per manufacturer's instructions.

B. Install hangers and supports per NECA 1 and NECA 101.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Box Support and Attachment: See Section 260533.16 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

K. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

L. Secure fasteners per manufacturer's recommended torque settings.

M. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Stainless steel rigid metal conduit (RMC).

C. Aluminum rigid metal conduit (RMC).

D. Galvanized steel intermediate metal conduit (IMC).

E. Stainless steel intermediate metal conduit (IMC).

F. PVC-coated galvanized steel rigid metal conduit (RMC).

G. Flexible metal conduit (FMC).

H. Liquidtight flexible metal conduit (LFMC).

I. Galvanized steel electrical metallic tubing (EMT).

J. Stainless steel electrical metallic tubing (EMT).

K. Aluminum electrical metallic tubing (EMT).

L. Rigid polyvinyl chloride (PVC) conduit.

M. Electrical nonmetallic tubing (ENT).

N. Liquidtight flexible nonmetallic conduit (LFNC).

O. Reinforced thermosetting resin conduit (RTRC).

P. High-density polyethylene (HDPE) conduit.

1.2 RELATED REQUIREMENTS

A. **Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.**

B. **Section 078400 - Firestopping.**

C. Section 260526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A) 2020.

D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.

E. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal) 2010 (Reapproved 2019).

F. ASTM D1598 - Standard Test Methods for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure 2021.

G. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings 2018.

H. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing 2020.

I. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing 2016.

J. ASTM D3485 – Standard Specification for coilable High Density Polyethylene (HDPE) Cable in Conduit.

K. ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing 2016a (Reapproved 2022).

L. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD) 2016.

M. ASTM F2176 - Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct 2017.

N. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

O. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.

P. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.

Q. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

R. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

S. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.

T. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.

U. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.

V. NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit 2021.

W. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).

X. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.

Y. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2021).

Z. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2020).

AA. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2021).

BB. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

CC. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

DD. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

EE. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.

FF. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.

GG. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

HH. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

II. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

JJ. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit Current Edition, Including All Revisions.

KK. UL 746C - Polymeric Materials – Use in Electrical Equipment Evaluations Current Edition, Including All Revisions.

LL. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

MM. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel Current Edition, Including All Revisions.

NN. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

OO. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

PP. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.

QQ. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

RR. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

SS. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.

TT. UL 2515 - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.

UU. UL 2515A - Standard for Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. **See Section 013000 - Administrative Requirements for submittals procedures.**

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings per manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized

steel rigid metal conduit, galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground .
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, stainless steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, stainless steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
7. Where galvanized steel electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
8. Where aluminum rigid metal conduit (RMC) or aluminum electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
9. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.

2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) where emerging from concrete.
5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches (100 mm) on either side of where conduit emerges.
6. Where aluminum rigid metal conduit (RMC) and aluminum electrical metallic tubing (EMT) is installed in concrete, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

1. Stub-ups extending above accessible ceilings: Terminate using a conduit bushing or insulated fitting if they are not terminated in a hub or enclosure.

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

1. Locations subject to physical damage include, but are not limited to:

a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

1. Locations subject to severe physical damage include, but are not limited to:

a. High traffic industrial and warehouse areas where exposed below 8 feet, except within electrical and communication rooms or closets.
b. Where exposed below 20 feet in industrial manufacturing areas.

L. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

M. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

1. Exterior locations subject to severe physical damage include, but are not limited to:

a. Where exposed to vehicular traffic below 20 feet.

N. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

O. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), stainless steel electrical metallic tubing (EMT), or reinforced thermosetting resin conduit (RTRC).

1. Corrosive locations include, but are not limited to:

    a. Cooling towers.
    b. Electroplating operations.
    c. Swimming pools and associated equipment areas.
    d. Wastewater treatment facilities.
    e. Marine environments.
    f. Chemical storage areas.

P. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).

Q. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

R. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:

    a. Engine Generators
    b. Transformers.
    c. Motors.

S. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

T. Medical Resonance Imaging (MRI) Room Conduit and Box Materials: All conduit and outlet boxes installed within MRI scan rooms shall be constructed of aluminum or other non-ferrous materials to prevent magnetic interference with imaging equipment. Aluminum RMC and aluminum EMT are approved for use, provided they are installed with supplementary corrosion protection when in contact with concrete or earth, as required by NFPA 70 (NEC) and UL standards. Cast aluminum boxes shall be used where aluminum conduit is installed, and all components—including fasteners, supports, and backboxes—must be non-ferrous. This requirement ensures compatibility with MRI shielding envelopes and maintains the integrity of the magnetic field calibration.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

1. Where permitted, existing conduits to be reused may be used as sole equipment grounding conductor only when continuity of conduit pathway, including associated boxes and fittings, is verified; see Section 260526.

C. Electrical Service Conduits: See Section 262100 for additional requirements.

D. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.

E. Provide conduit, fittings, supports, and accessories required for complete raceway system.

F. Provide products listed, classified, and labeled as suitable for purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4-inch trade size.
2. Branch Circuit Homeruns: 3/4-inch trade size.
3. Control Circuits: 1/2-inch trade size.
4. Flexible Connections to Luminaires: 3/8-inch trade size.
5. Underground, Interior: 3/4-inch trade size.
6. Underground, Exterior: 1-inch trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International
2. Rymco USA
3. Western Tube, a division of Zekelman Industries
4. Wheatland Tube, a division of Zekelman Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Factory-Painted, Color-Coded Galvanized Steel RMC: Apply according to indicated color code.

1. See Section 260553 for color code.

D. Fittings:

1. Manufacturers:

a. ABB; T&B
b. Allied Tube & Conduit, a division of Atkore International
c. Bridgeport Fittings Inc
d. Emerson Electric Co; O-Z/Gedney
e. Picoma Industries, Inc.

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL
4. 1203 for classification of installed location.
5. Material: Use steel or malleable iron.

a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.

6. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
7. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.4 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Calbrite, a division of Atkore International
2. Gibson Stainless & Specialty Inc
3. Patriot Industries, a division of Patriot Aluminum Products LLC
4. Rymco USA

B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

1. Material: Type 304 or 316 stainless steel.

C. Fittings:

1. Manufacturers:

a. Calbrite, a division of Atkore International
b. Eaton
c. Gibson Stainless & Specialty Inc
d. Patriot Industries, a division of Patriot Aluminum Products LLC

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.5 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International
2. Nucor Tubular Products
3. Picoma Industries, Inc.
4. Rymco USA
5. Western Tube, a division of Zekelman Industries
6. Wheatland Tube, a division of Zekelman Industries

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:

1. Manufacturers:

a. ABB; T&B
b. Allied Tube & Conduit, a division of Atkore International
c. Bridgeport Fittings, LLC
d. Emerson Electric Co; O-Z/Gedney

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.6 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International
2. Nucor Tubular Products
3. Rymco USA
4. Western Tube, a division of Zekelman Industries
5. Wheatland Tube, a division of Zekelman Industries

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:

    a. ABB; T&B
    b. Allied Tube & Conduit, a division of Atkore International
    c. Bridgeport Fittings, LLC
    d. Emerson Electric Co; O-Z/Gedney

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.

    a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.

5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.7 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Manufacturers:

    a. Calbrite, a division of Atkore International
    b. Eaton

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use stainless steel with corrosion resistance equivalent to conduit.

5. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.8 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. ABB; Ocal
2. Calbond, a division of Atkore International
3. Robroy Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. PVC-Coated Boxes and Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.9 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, a division of Atkore International
2. Electri-Flex Company
3. International Metal Hose

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:

1. Manufacturers:

a. ABB; T&B
b. Anamet Electrical, Inc.
c. Emerson Electric Co; O-Z/Gedney

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.10 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, a division of Atkore International
2. Electri-Flex Company
3. International Metal Hose
4. Lamson & Sessions.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Manufacturers:

a. ABB; T&B
b. Anamet Electrical, Inc.
c. Bridgeport Fittings, LLC
d. Emerson Electric Co; O-Z/Gedney

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.11 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International
2. Nucor Tubular Products
3. Picoma Industries, Inc.
4. Rymco USA
5. Western Tube, a division of Zekelman Industries
6. Wheatland Tube, a division of Zekelman Industries

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:

a. ABB; T&B
b. Bridgeport Fittings, LLC
c. Emerson Electric Co; O-Z/Gedney

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.
7. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.12 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Calbrite, a division of Atkore International

B. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

C. Fittings:

1. Manufacturers:

a. Calbrite, a division of Atkore International

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use stainless steel with corrosion resistance equivalent to conduit.
4. Connectors and Couplings: Use compression/gland or set-screw type.
5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.13 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. American Conduit, a division of Hydro

B. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

C. Fittings:

1. Manufacturers:

a. Arlington Industries
b. Bridgeport Fittings, LLC

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
3. Material: Use aluminum.
4. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.
6. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.14 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. ABB; Carlon
2. Allied Tube & Conduit, a division of Atkore International
3. Cantex Inc
4. Heritage Plastics, a division of Atkore International
5. JM Eagle
6. Kraloy.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

D. **Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.**

2.15 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:

1. ABB; Carlon
2. Cantex Inc
3. IPEX, a division of Aliaxis

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

C. Fittings:

1. Manufacturer: Same as manufacturer of ENT to be connected.
2. Use solvent-welded type fittings.
3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.16 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:

1. AFC Cable Systems, a division of Atkore International
2. Electri-Flex Company
3. IPEX, a division of Aliaxis

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.17 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Manufacturers:

1. Champion
2. FRE Composites
3. United Fiberglass of America, Inc

B. Applications:

1. Above Ground, Not Subject to Physical Damage: Use aboveground (AG), SW (Standard Wall), HW (Heavy Wall), or XW (Extra Heavy Wall) RTRC.
2. Above Ground, Subject to Physical Damage: Use aboveground (AG), XW (Extra Heavy Wall) RTRC.

3. Underground, Direct-Buried: Use below ground (BG), DB (direct-burial) RTRC or aboveground (AG) RTRC.
4. Underground, Embedded in Concrete: Use below ground (BG), EB (encased-burial) RTRC, below ground (BG), DB (direct-burial) RTRC, or aboveground (AG) RTRC.
5. Do not use RTRC in hazardous/classified locations.

C. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

1. Aboveground (AG) RTRC: Comply with NEMA TC 14.AG and list and label as complying with UL 2515.
2. Aboveground (AG), XW (Extra Heavy Wall) RTRC: Comply with NEMA TC 14.XW and list and label as complying with UL 2515A.
3. Below ground (BG) RTRC: Comply with NEMA TC 14.BG and list and label as complying with UL 2420.

D. Supports: As recommended by manufacturer.

E. Fittings: Same type and manufacturer as conduit to be connected.

1. Cement-Tight Joints: Use bonded coupling or bell and spigot.
2. Cement-Tight and Watertight Joints: Use adhesive and manufacturer's standard gaskets.
3. Expansion Fittings: To match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.18 HIGH-DENSITY POLYETHYLENE (HDPE) CONDUIT

A. Manufacturers:

1. ABB; Carlon
2. Blue Diamond Industries, LLC
3. Eastern Wire + Conduit, a division of Atkore International

B. Description: NFPA 70, Type HDPE high-density polyethylene solid-wall conduit complying with ASTM F2160 and NEMA TC 7; list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.

C. Joining Methods: Approved by HDPE conduit manufacturer.

D. Mechanical Fittings: Comply with ASTM F2176; list and label as complying with UL 651A.

E. Butt Heat Fusion Fittings: Comply with ASTM D3261.

F. Socket Fusion Fittings: Comply with ASTM D2683.

G. Electrofusion Fittings: Comply with ASTM F1055.

2.19 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Adhesive for HDPE and RTRC Conduit:

1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
2. Approved by adhesive manufacturer for use with materials to be joined.
3. Adhesive Shear Strength: Not less that 100 psi (720 kPa), when tested per ASTM D1002.
4. Hydrostatic Pressure Resistance: No leaks, when tested per ASTM D1598 at 120 psi (830 kPa) for 1,000 hours and when tested per ASTM D1599 at 250 psi (1700 kPa).
5. Products:

    a. American Polywater Corporation; Polywater BonDuit Conduit Adhesive

F. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

G. Foam Conduit Sealant:

1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Rated to hold minimum of 10 ft water head pressure.
4. Products:

    a. American Polywater Corporation; Polywater AFT Foam Duct Sealant
    b. American Polywater Corporation; Polywater FST Foam Duct Sealant

H. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.
2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around conductors/cables to be installed.
4. Products:

a. American Polywater Corporation; PHRD SG Mechanical Seals

I. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

J. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
3. Products:

a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

K. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:

a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals
b. Menzies Metal Products; Electrical Roof Stack and Cap
c. Menzies Metal Products; Electrical Retro Box

L. 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.

1. Products:

a. Quickflash Weatherproofing Products, Inc

M. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built

N. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

1. Products:

    a. Advance Products & Systems, LLC; Duct Bank Spacers

O. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

1. Products:

    a. Advance Products & Systems, LLC; Bore Spacers

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products per manufacturer's instructions.

B. Install conduit per NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) per NECA 101.

D. Install aluminum rigid metal conduit (RMC) per NECA 102.

E. Install intermediate metal conduit (IMC) per NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit per NECA 111.

H. Install electrical nonmetallic tubing (ENT) per NECA 111.

I. Install liquidtight flexible nonmetallic conduit (LFNC) per NECA 111.

J. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:

    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.

5. Unless otherwise approved, do not route exposed conduits:

a. Across floors.
b. Across roofs.
c. Across top of parapet walls.
d. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

    a. Heaters.
    b. Hot water piping.

14. Group parallel conduits in same area on common rack.

K. Conduit Support:

1. Secure and support conduits per NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.

    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is permitted only as follows:

a. Support of electrical metallic tubing (EMT) up to 1-inch trade size concealed above accessible ceilings and within hollow stud walls.

10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

L. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.

a. Provide insulating bushings on termination locations subject to moisture or vibration to protect the conductors. Including conductors smaller than No. 4 AWG.

8. Secure joints and connections to provide mechanical strength and electrical continuity.
9. Cut the conduit at a right angle to its length. For conduits with a trade size of 2 inches or larger, utilize a roll cutter or a guide to ensure a straight and perpendicular cut.

M. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations.

Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

N. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:

a. Underground, Exterior: 18 inches.
b. Under Slab on Grade: 12 inches to bottom of slab.

2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 260553.

O. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
2. Secure conduits to prevent floating or movement during pouring of concrete.

P. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated**<<; see Section 033000.>>**

Q. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated per NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated per NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where calculated per NFPA 70 for metal conduit installed above ground to compensate for thermal expansion.
5. Where conduits are subject to earth movement by settlement or frost.

R. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

a. Where conduits enter building from outside.
b. Where service conduits enter building from underground distribution system.
c. Where conduits enter building from underground.
d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

    a. Where conduits pass from outdoors into conditioned interior spaces.
    b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or per NFPA 70.

S. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Use polypropylene or monofilament plastic string with a minimum of 200-lb tensile strength. Leave minimum slack of 12 inches at each end.

T. **<<Provide grounding and bonding; see Section 260526.>>**

U. **<<Identify conduits; see Section 260553.>>**

3.2 FIELD QUALITY CONTROL

A. **<<See Section 014000 - Quality Requirements for additional requirements.>>**

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair per manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.3 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.4 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Floor boxes.

F. Underground boxes/enclosures.

G. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 270533.13 - Conduit for Communications Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

F. Section 262726 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.

3. Poke-through assemblies.
4. Access floor boxes.
5. Poke-Throughs.
6. Service Poles.
7. Multioutlet Assemblies.
8. Additional requirements for locating boxes for wiring devices.

G. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

H. Section 337119 – Electrical Underground Ducts, Ductbanks, and Manholes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Pull Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.

N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams for power, signal, and control wiring.

E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. **See Section 016000 - Product Requirements, for additional provisions.**
2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
6. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

B. Outlet and Device Boxes Up to 100 cubic inches, including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
6. Use suitable concrete type boxes where flush-mounted in concrete.
7. Use suitable masonry type boxes where flush-mounted in masonry walls.
8. Use raised covers suitable for the type of wall construction and device configuration where required.
9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Minimum Box Size, Unless Otherwise Indicated:

    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep trade size.

17. Wall Plates: Comply with Section 262726.
18. Manufacturers:

    a. Adalet
    b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    c. Crouse-Hinds, an Eaton business.
    d. EGS/Appleton Electric.
    e. FSR Inc.
    f. Hoffman; a brand of Pentair Equipment Protection.
    g. Hubbell Incorporated
    h. Lamson & Sessions.
    i. Milbank Manufacturing Co.
    j. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    k. Thomas & Betts Corporation, A Member of the ABB Group

l. Wiremold / Legrand.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:

a. Indoor Clean, Dry Locations: Type 1, painted steel.
b. Outdoor Locations: Type 3R, painted steel.

3. Junction and Pull Boxes Larger Than 100 cubic inches:

a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:

a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
b. Provide continuous-hinge cover with flush latch unless otherwise indicated.
c. Back Panels: Painted steel, removable.
d. Terminal Blocks: Provide voltage and current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
e. Provide metal barriers to separate wiring of different systems and voltage.
f. Provide accessory feet where required for freestanding equipment.

5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:

a. Adalet
b. Cooper B-Line, a division of Eaton Corporation
c. Hoffman, a brand of Pentair Technical Products
d. Hubbell Incorporated; Wiegmann Products

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

1. Manufacturers:

a. Hubbell Incorporated
b. FSR
c. Legrand

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

1. Manufacturers:

    a. Adalet
    b. Appleton, a brand of Emerson Electric Co
    c. Cooper Crouse-Hinds, a division of Eaton Corporation
    d. Hubbell Incorporated; Killark Products
    e. FSR
    f. Legrand

F. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast-iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
4. Applications:

    a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.

    a. Manufacturers:

        1) Hubbell Incorporated; Quazite Products
        2) MacLean Highline
        3) Oldcastle Precast, Inc

    b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
    c. Product(s):

        1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
        2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
        3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.

6. **Air Tight Boxes**

   a. **PVC, Phenolic or Polycarbonate Non-metallic boxes shall be listed and comply with NEMA OS-2**
   b. **High-strength thermoplastic polymer construction**
   c. **Thermoplastic material with a drywall flange covered with a closed-cell foam gasket and additional gaskets over cable entry points to provide a vapor-tight seal.**

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

   1. Manufacturers:

      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated. Give priority to ADA requirements. Install boxes with height measured from finished floor to center of box unless otherwise indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.

    a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
    b. Communications Systems Outlets: Comply with Section 271000.

4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, or as required to facilitate installation of conductors, and to limit conduit length and number of bends between pulling points in accordance with Section 260533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:

    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad **constructed in accordance with Section 033000**.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.
2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300-volts.

R. Install firestopping to preserve fire resistance rating of partitions and other elements**, using materials and methods specified in Section 078400**.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. **Provide grounding and bonding in accordance with Section 260526.**

V. **Air Tight Box**

1. **Provide air tight boxes at the following**

a. **Exterior walls**
b. **Ceilings with vapor barriers**
c. **Demising walls**

END OF SECTION

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SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

C. Wall duct.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems

B. Section 260529 - Hangers and Supports for Electrical Systems

1. Includes metal channel (strut) used as raceway

C. Section 260533.13 - Conduit for Electrical Systems

D. Section 260533.16 - Boxes for Electrical Systems

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway 2021.

E. UL 5 - Surface Metal Raceways and Fittings Current Edition, Including All Revisions.

F. UL 5A - Nonmetallic Surface Raceways and Fittings Current Edition, Including All Revisions.

G. UL 111 - Outline of Investigation for Multioutlet Assemblies Current Edition, Including All Revisions.

H. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Wall Duct: Coordinate the work with other trades to provide walls suitable for installation of flush-mounted wall duct where indicated.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
6. Coordinate manufacturer's standard enamel finish color with Architect.

B. Sequencing:

1. Do not install raceways until final surface finishes and painting are complete.
2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.

1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.2 SURFACE RACEWAY SYSTEMS

A. Manufacturers:

1. Hubbell Incorporated
2. Legrand North America, Inc
3. MonoSystems, Inc
4. Panduit Corp.

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

E. Metal Channel (Strut) Used as Raceway: Comply with Section 260529.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers:

1. Eaton Corporation
2. Enduro Composites
3. Hoffman; a brand of Pentair Equipment Protection.
4. MonoSystems, Inc.
5. nVent
6. Schneider Electric

B. Description: Lay-in metal wireways and auxiliary gutters with hinged covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:

1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with hinged cover.
2. Outdoor Locations: NEMA 250, Type 3R, painted steel with hinged cover; include provision for padlocking.

D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

E. Minimum Wireway Size: 4 by 4 inches (100 by 100 mm) unless otherwise indicated.

F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers:

1. Hoffman; a brand of Pentair Equipment Protection.
2. Lamson & Sessions.
3. Niedax Inc.

B. Description: Lay-in nonmetallic wireways and auxiliary gutters with hinged covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:

1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted PVC or Fiberglass with hinged cover.
2. Outdoor Locations: NEMA 250, Type 3R, painted PVC or Fiberglass with hinged cover; include provision for padlocking.

D. Finish for Painted Nonmetallic Wireways: Manufacturer's standard grey unless otherwise indicated.

E. Minimum Wireway Size: 4 by 4 inches unless otherwise indicated.

F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.5 WALL DUCT

A. Manufacturers:

1. Dennis Filges Company, Inc
2. Hubbell Incorporated
3. Schneider Electric
4. Legrand North America, Inc
5. Source Limitations: Where the wall duct system includes connections to trench duct as specified in Section 260539, furnish wall duct and associated

components produced by the same manufacturer as the trench duct to be installed.

B. Description: Metal raceways specifically designed for enclosure of wiring to X-ray machines and similar medical equipment; listed and labeled as complying with UL 870.

C. Material: Steel, unless otherwise indicated.

D. Mounting Provisions: Suitable for surface- or flush-mounting as indicated.

E. Size: As indicated on the drawings.

2.6 SOURCE QUALITY CONTROL

A. See Division 01 - Quality Requirements, for additional requirements.

B. Factory test each production unit for pre-wired surface raceway systems to verify proper wiring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Surface Nonmetallic Raceways: Install in accordance with NEMA PRP 5.

D. Install raceways plumb and level.

E. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

F. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.

G. Close unused raceway openings.

H. Provide grounding and bonding in accordance with Section 260526.

I. Identify raceways in accordance with Section 260553.

J. When installing surface raceway, ensure there is a minimum 2-inch radius control at bend points.

K. Fasten surface raceway using screws or similar anchor-type devices, spacing them at intervals of no more than 48 inches. Ensure there are at least two supports per straight section of raceway. Adhere to the manufacturer's written instructions for properly supporting surface raceway. Avoid using tape and glue as support methods, as they are not acceptable.

L. Raceway Sealing:

1. See Conduit Sealing in Section 260533.13 – Conduit for Electrical Systems, for requirements.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - Quality Requirements, for additional requirements.

B. Inspect raceways for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective raceways.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 260500 - Common Work Results for Electrical, Communications, and Electronic Safety and Security Systems.

B. **Section 099123 - Interior Painting.**

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 262726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace Latest Edition.

C. UL 969 - Marking and Labeling Systems Latest Edition, Including All Revisions.

D. ANSI Z535 - Safety Alerting Standards

E. ASME A13.1 - Scheme for the Identification of Piping Systems

F. 29 CFR 1910.144 - Color Identification

G. 29 CFR 1910.145 - Warning Signs and Tags

H. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics

I. UL 94 - Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing

1.4 PRECEDENCE

A. Where identification requirements are specified in the Drawings, those requirements shall take precedence over the requirements of this Section.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products. Verify colors and abbreviations as well, and do not change standards during the installation.

B. Sequencing:

1. Do not conceal items to be identified in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.8 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements. Return original identification to Owner.

B. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchgear, Switchboards, and Motor Control Centers

1) Identify name or tag designation.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Example: “MCC-2, 120/208-3PH-4W, 800A MCB, from SWG-1-8/10/12 via (2) 4”C,4#500,1#1/0G THHN”

b. Panelboards:

1) Identify name.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Example: “Panel L1, 120/208-3PH-4W, 100A MLO, from Panel H1-8/10/12 via 2”C,4#2,1#8G THHN”
6) Use dated typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
7) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

c. Transformers:

1) Identify name.
2) Identify kVA rating.
3) Identify voltage and phase for primary and secondary.
4) Identify the primary and secondary feeder sizes.

5) Identify the source and load.
6) Example: “TF-1, 45KVA, 480-208/120V, from Panel H1 via 1-1/4”C,3#1,1#8G, to Panel L1 via 2”C,4#2/0,1#4G.

d. Enclosed switches, circuit breakers, heater disconnects, starters, variable-speed controllers, and motor controllers:

1) Identify device serviced, i.e. “Panel L1, HVAC Unit #1, Capacitors”, etc.
2) Identify motor number as listed in the Motor Starter and Control Schedule (if applicable)
3) Identify motor number as listed in the appropriate schedule on the mechanical drawings.
4) Identify voltage and phase.
5) Identify power source and circuit number. Include location when not within sight of equipment.

e. Busway:

1) Identify name.
2) Identify ampere rating.
3) Identify voltage and phase.
4) Identify power source and circuit number. Include location when not within sight of equipment.
5) Example: “BD-1, 277/480-3PH-4W, 600A, from MSB-1 via (2)3-1/2”C,4#500 kcmil,1#1/0G THHN.”

f. Time Switches, Push-Button Stations, Remote-Controlled Switches, Dimmer Modules, Thermostats, Motor Toggle Switches, and Control Devices:

1) Identify device serviced, i.e. “Parking Lot Lights”, “Night Lights”, “Exterior Security Lights”, “Night Set Back Control”, “Garage Heater”, “AC Fan Unit”, etc.
2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
3) Examples: “Parking Lot Lights 208-2PH-2W, LP4-13/15”, “Toilet Exh 208-3PH-3W, L1-2/4/6”, “Heater 480-3PH-4W, P1-7/9/11”, “A.C. Unit #1 480-3PH-4W, H1-1/3/5”

g. Enclosed Contactors:

1) Identify ampere rating.
2) Identify voltage and phase.

h. Centralized Emergency Lighting Inverters and Battery-Inverter Units:

1) Identify input and output voltage and phase.
2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.

i. Transfer Switches:

1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

j. Electricity Meters:
k. Battery Racks:
l. Power Generating Units
m. Monitoring and Control Equipment
n. UPS Equipment Terminal cabinets
o. Racks

2. Service Equipment:

a. Use identification nameplate to identify each service disconnecting means.

3. Emergency System Equipment:

a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.

a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.
b. Warning labels: Labels with the word message “WARNING – OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES.”

12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

    a. Service equipment.
    b. Industrial control panels.
    c. Motor control centers.
    d. Elevator control panels.
    e. Industrial machinery.

13. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

    a. Comply with requirements for arc-flash warning labels in Section 260573 “Power System Studies”.
    b. Comply with NFPA 70 E and ANSI Z535.4.
    c. Minimum Size: 3.5 by 5 inches.
    d. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
    e. Service Equipment: Include the following information in accordance with NFPA 70, section 110.16 and ANSI Z535.4.

        1) Nominal system voltage.
        2) Available fault current.
        3) Clearing time of service overcurrent protective device(s).
        4) Date label applied.

14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
18. Apply additional signs in accordance with 29CFR1910.145 for indoor cabinets, boxes, and enclosures. Use self-adhesive or baked-enamel warning signs.

Identify the system voltage with black letters on an orange background. Apply to the exterior of the door, or cover.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Power Conductors More Than 600 V: For conductors in manholes, handholes, vaults, and pull and junction boxes, use write-on tags or preprinted nonmetallic tags colored and marked to indicate phase, with a separate tag for the circuit designation.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

    a. Outlet boxes:

        1) Wire markers to indicate source and circuit (i.e.: “L1-3”).
        2) Mark the inside of the box (side or back) with permanent marker to indicate the source and circuit numbers of the conductors in the box (i.e.: “L1, 7/9”).

    b. Junction Boxes and Pullboxes:

        1) Wire markers to indicate source and circuit (i.e.: “L1-3”).
        2) Mark the inside of the box (side or back) with permanent marker to indicate the source and circuit numbers of the conductors in the box (i.e.: “L1, 7/9”).
        3) Tag attached by string to each group of conductors that enter the pull box or junction box (i.e., one tag per conduit). Tags market with a black indelible felt tip pen to indicate the circuit numbers of the conductors (i.e.: “L1-7, 9, 11”)

    c. Panelboards and other electrical enclosures:

        1) Tags attached to the conductors by strings. Tags marked with a black indelible felt tip pen to indicate the load served by that conductor (i.e.: “Lighting, Office #204”).

5. Control Circuit Conductors:

    a. Identification: For conductors and cables in pull and junction boxes, handholes, and manholes, self-adhesive vinyl labels, self-adhesive, self-laminating polyester labels, or write-on tags. Include the conductor or cable designation, source, and destination.

b. Termination Identification: Provide preprinted heat-shrink tubes, self-adhesive, self-laminating polyester labels, or self-adhesive vinyl labels. Include the cable designation.

6. Conductors or Cables To Be Extended in the Future: Attach write-on tags or marker tape to conductors or cables. Include the conductor or cable source.
7. Auxiliary Electrical System Conductors: Identify field-installed alarm, control, and signal conductors.

   a. Identify terminals, conductors, and cables in enclosures and at terminals, pull points, and junctions. Include the system and circuit designation.
   b. Coordinate identification with manufacturer's wiring diagrams, Project Drawings, and the operation and maintenance manuals.
   c. Use a uniform marker-tape designation system that is consistent with the system used by the manufacturer for factory-installed connections.

D. Identification for Raceways:

1. Concealed Raceways, Duct Banks, More Than 600V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers in waterproof, nonfading black paint or ink. Stop stripes at legends. Apply stripes to the following finished surfaces:

   a. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
   b. Wall surfaces directly external to raceways concealed within wall.
   c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

2. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 volts: Painted entire length and stenciled 1-inch-high black letters every 25 feet in waterproof, nonfading black paint or ink.

   a. 4160v – Yellow.
   b. 13800v - Orange.

3. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.
4. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

   a. "EMERGENCY POWER."
   b. "POWER."
   c. "UPS."

d. Identification of Communications, Electronics Safety and Security Systems.

E. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color-coded boxes to identify systems other than normal power system.

a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.

F. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 271000.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Factory Pre-Marked Wallplates: Comply with Section 262726.
4. Use identification label to identify fire alarm system devices.

G. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:

a. Brimar Industries, Inc
b. Kolbi Pipe Marker Co
c. Seton Identification Products

2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes. Fasteners shall be stainless steel. Either use self-tapping screws or machine screws with flat washers, lock washers, and nuts.

B. Identification Labels:

1. Manufacturers:

a. Brady Corporation
b. Brother International Corporation
c. Panduit Corp

2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
4. **Materials and Text: Use engraved, laminated 1/8 inch acrylic or melamine label: punched or drilled for screw mounting or permanent bonding epoxy glue.**

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:

a. System designation where applicable:

1) Emergency Power System: Identify with text "EMERGENCY".
2) Fire Alarm System: Identify with text "FIRE ALARM".

b. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:

a. System Designation: 1 inch.
b. Equipment Designation: 1/2 inch.
c. Other Information: 1/4 inch.
d. Refer to ASME A13.1 for additional requirements.

5. Color:

a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.
c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

    a. Exceptions:

        1) Provide white text (minimum text height of 3/8 inch) on red background for general information or operational instructions for emergency systems, i.e., load shedding or power transfer equipment.
        2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Materials

1. Tags:

a. Metal Tags: 2 by 2 by 0.05 inch, with hole punch for cable ties, and stamped legend.
b. Nonmetallic Preprinted Tags: **0.015 inch** thick, polyethylene, with hole for cable ties. Color code for phase and voltage. Designations to be factory screened or permanently printed.
c. Write-On Tags: **0.10 inch** thick, corrosion-resistant grommet, and cable tie.
d. Tag Marker: Permanent black ink marker, waterproof, recommended by tag manufacturer.
e. Tag Marker: Machine printed black ink, permanent, waterproof, recommended by printer manufacturer.

2. Ties:

a. All ties to be flame and bacteria and fungus-resistant nylon; one piece, self-locking, 3/16 inch or greater width; black color unless used for color codes. Cables shall be rated for temperatures ranging from -40 to 185°F. Cables shall be rated for a tensile strength of 12,000 psi at 73°F (according to Standard ASTM D 638).
b. Outdoors: Ties must also be UV-resistant, self-extinguishing, type 6/6 nylon.
c. Plenum spaces such as above drop ceilings or below raised flooring: Ties must be plenum-rated. Ties must also comply with a UL 94 flame rating of V-0. Cables shall be rated for temperatures ranging from -50 to 284°F. Tensile strength requirements may be reduced to 7,000 psi at 73°F.

3. Sleeves:

a. Heat-Shrink Preprinted Sleeves: Polyolefin, flame-retardant, with machine printed labels. Diameters sized to shrink to fit onto raceways and cables. Shall comply with UL 224.
b. Snap-Around Color-Coding Sleeves: 2 inches in length, slit, flexible, pretensioned, solid-colored acrylic. Diameters sized to match raceways and cables.

D. All markers must be securely attached.

E. Legend: Power source and circuit number or other designation indicated.

F. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

G. Minimum Text Height: 1/8 inch.

H. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

B. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

C. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:

a. Emergency Power System: Text "EMERGENCY".

D. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Seton Identification Products

B. Comply with ANSI Z535.1, ANSI Z535.2, and ANSI Z535.5 as applicable.

C. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

D. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

E. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

F. Legend: Type of service, continuously repeated over full length of tape.

G. Color:

1. Tape for Buried Power Lines: Black text on red background.

2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Insite Solutions, LLC
4. Seton Identification Products

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc
2. Clarion Safety Systems, LLC
3. Insite Solutions, LLC
4. Seton Identification Products

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:

1. Materials:

a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners. Fasteners shall be stainless steel. Either use self-tapping screws or machine screws with flat washers, lock washers, and nuts.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

E. Floor Signs:

1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlaminate; removable.
2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Ensure identification products are accessible by installing additional visibility windows or access covers where needed. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.
11. Busway: Every 50 feet along length of busway.
12. Bus Plugs: Legible from the floor.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260573
POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; Latest Edition.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; Latest Edition.

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; Latest Edition.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; Latest Edition.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; Latest Edition.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; Latest Edition.

G. NEMA MG 1 - Motors and Generators; Latest Edition.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; Latest Edition.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; Latest Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
2. Notify Architect and engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:

1. Submit short-circuit, protective devices coordination and arc flash study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Engineer.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).
4. Perform the arc-flash study after the short-circuit study and protective device coordination study have been completed.

D. Scheduling:

1. Arrange access to existing facility for data collection with Owner.
2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

A. **See Section 013000 - Administrative Requirements, for submittal procedures.**

B. Study preparer's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Include characteristic time-current trip curves for protective devices.
2. Include documentation of listed series ratings upon request.
3. Identify modifications made in accordance with studies that:

a. Can be made at no additional cost to Owner.
b. As submitted will involve a change to the contract sum.

E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

F. Site-specific arc flash hazard warning labels.

G. Field quality control reports.

H. Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of both new and directly affected existing portions of electrical distribution system as indicated on drawings.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:

1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling. Use a tagging system to cross-reference the one-line diagram with the data sheets.

a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.

1) Obtain up-to-date information from Utility Company.

b. Generators: Include manufacturer/model, kW and voltage ratings, thermal-damage curve, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, thermal-damage curve, starting time, service factor, and locked rotor current or NEMA MG 1 code letter designation.
d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, inrush current, overload capability, and X/R ratio.
e. Protective Devices:

1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
h. Miscellaneous Loads: Include voltage rating and full load amps. Identify loads with starting inrush currents and frequent stopping and starting.
i. Distribution Equipment: Include ampacity and Short Circuit Current Rating (SCCR).

2. Existing Installations:

a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.
b. Where examination of the equipment requires energized equipment to be opened, with owner approval, provide a Qualified Person to directly supervising any non-Qualified Person within the hazard area. Use PPE, protective barriers, danger signs and other safety devices to protect and warn personnel in the vicinity of energized equipment being examined.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a. Maximum utility fault currents.
b. Maximum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

    a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
    b. Calculations for buses with multiple sources shall consider how the sources vary over time due to interrupting and decay when considering cumulative energy.

        1) Generators and synchronous motors shall have their fault contribution decay over time to match their actual rate of decay.
        2) Induction motors do not need to be considered beyond 3-5 cycles.

3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.

4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:

    a. Identify date of study and study preparer.
    b. Identify study methodology and software product(s) used.

c. Identify scope of studies, environmental conditions, derating factors, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports and indicate bus voltage.
f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:

1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
4) Voltage.

b. For momentary duty reports, only include the items above.
c. For low voltage fault reports, also include the equivalent impedance at each device.
d. For interrupting duty reports, also include the equivalent impedance, the No AC Decrement (NACD) ratio, and the multiplication factors for 2-, 3-, 5-, and 8-cycle circuit breakers on a symmetrical and total basis.
e. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
f. Provide a table listing maximum short circuit currents versus protective device withstand ratings for all rated devices, Provide separate tables for symmetrical and asymmetrical ratings.

3. Protective Device Coordination Study:

a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b. For each graph include (where applicable):

1) Partial single-line diagram identifying the portion of the system illustrated.
2) Identify each device curve with its manufacturer type, function, and tap and time settings where applicable.
3) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
4) Conductors: Damage curves.
5) Transformers: Inrush points, damage curves, and through-fault protection curves.
6) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
7) Motors: Full load current, starting curves, and damage curves.
8) Capacitors: Full load current and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings. When available, record settings using the manufacturer's data sheets.

1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse rating, class, and voltage.
4) Protective Relays: Include device tag, current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:

a. For the worst case for each scenario, identify at each bus location:

1) Calculated incident energy.
2) Hazard risk category and associated working distance.
3) Calculated arc flash boundary, and limited and restricted approach boundaries.
4) Bolted fault current.
5) Arcing fault current.
6) Clearing time.
7) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by manufacturer of electrical distribution equipment.
2. Study preparer may be employed by field testing agency.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Products:

a. EasyPower LLC
b. ETAP/Operation Technology, Inc
c. SKM Systems Analysis, Inc

PART 2 - PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 260553.
2. Minimum Size: 3.5 by 5 inches.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include orange header that reads "WARNING" unless otherwise indicated.
b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
c. Include the following information:

1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Site-specific PPE (personnel protective equipment) requirements:

(a) PPE minimum arc rating (Cal/cm^2).

4) Nominal system voltage.
5) Limited approach boundary.
6) Restricted approach boundary.
7) Equipment identification.
8) Available Fault Current
9) Short Circuit Current Rating (if applicable)
10) Date calculations were performed, as well as the engineering report number and revision number.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. **See Section 014000 - Quality Requirements, for additional requirements.**

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect and Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

SECTION 260583
WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; Latest Edition.

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; Latest Edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Enclosed Switches: As specified in 262816.16

C. Wiring Devices: As specified in 262726

D. Flexible Conduit: As specified in 260533.13

E. Wire and Cable: As specified in 260519

F. Boxes: As specified in 260533.16

PART 3 - EXECUTION

3.1 ELECTRICAL CONNECTIONS

A. Make electrical connections per equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

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SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Occupancy and vacancy sensors.

B. Outdoor motion sensors.

C. Time switches.

D. In-wall time switches.

E. In-wall interval timers.

F. Outdoor photo controls.

G. Daylighting controls.

H. Lighting contactors.

I. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262726 - Wiring Devices: Devices for manual control of lighting, including **wall switches, wall dimmers, and fan speed controllers.**

1. Includes finish requirements for wall controls specified in this section.
2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

E. Section 262813 - Fuses.

F. Section 262913 - Enclosed Controllers: General purpose contactors.

G. Section 265100 - Interior Lighting.

H. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; Latest Edition.

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 20232015.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.

H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

J. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

K. NFPA 70 - National Electrical Code **Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements**.

L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Latest Edition, Including All Revisions.

M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Latest Edition, Including All Revisions.

N. UL 916 - Energy Management Equipment; Latest Edition, Including All Revisions.

O. UL 917 - Clock-Operated Switches; Latest Edition, Including All Revisions.

P. UL 1472 - Solid-State Dimming Controls; Latest Edition, Including All Revisions.

Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Latest Edition, Including All Revisions.

R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Latest Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes **and painting** are complete.

1.5 SUBMITTALS

A. **See Section 013000 - Administrative Requirements, for submittal procedures.**

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

H. **Electronic Trip Circuit Breakers: Provide one portable test set.**

I. Indicating Lights: Provide **Two** of each different type.

J. Project Record Documents: Record actual installed locations and settings for lighting control devices.

K. Software and Firmware Documentation: Include operating manuals and backup of program software (USB drive or website).

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum **five** years experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide **five**-year manufacturer warranty for all occupancy sensors.

C. Provide **five**-year manufacturer warranty for all daylighting controls.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY AND VACANCY SENSORS

A. Manufacturers:

1. Acuity Brands, Inc; Lithonia Lighting, Sensor Switch
2. Cooper Lighting.
3. Hubbell Incorporated.
4. IntermaticLighting, Inc.
5. Legrand North America, Inc; Wattstopper.
6. Leviton
7. Lutron, Inc
8. Nexlight
9. NSI Industries LLC; TORK
10. Philips; Dynalite: www.dynalite.com
11. RAB Lighting, Inc: www.rablighting.com/#sle.
12. Steinel America: www.steinel.net/#sle
13. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy and Vacancy Sensors:

1. Description: Factory-assembled **commercial specification grade** devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:

    a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.

3. Provide LED to visually indicate motion detection **with separate color LEDs for each sensor type in dual technology units**.
4. Operation:

   a. Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   b. Unless otherwise indicated, vacancy sensor to turn load off (after manual on) when no occupant presence is detected during an adjustable turn-off delay time interval.

5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable**, with time delay settings up from 1 to 3015 minutes**.
8. Adaptive Technology: Field selectable**, capable of self-adjusting sensitivity and time delay according to conditions**.
9. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
10. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
11. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
12. Wireless Sensors:

    a. RF Range: **30 feet** through typical construction materials.
    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    c. Power: Battery-operated with minimum **ten-year** battery life.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:

   a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees**, integrated manual control capability, automatic control only (no, integrated manual control capability)**, and no leakage current to load in off mode.
   b. Unless otherwise indicated or required to control the load indicated on drawings, provide **low voltage units.**

c. Operation: **Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).**
d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
e. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
f. Provide vandal resistant lenses for **passive infrared (PIR) and dual technology** occupancy sensors where indicated.

2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of **900 square feet**.
3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of **400 square feet**.
4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of **900 square feet**.

D. Wall Dimmer Occupancy Sensors:

1. General Requirements:

a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
b. Operation: **Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).**
c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472 type and rating suitable for load controlled.
e. Provide field adjustable dimming preset for occupied state.
f. Provide fade-to-off operation to notify occupant of impending load turn-off.
g. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet

E. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:

a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Unless otherwise indicated or required to control the load indicated on drawings, provide **low voltage units, for use with separate compatible accessory power packs**.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of **<<450 square feet>>** at a mounting height of **<<9 feet>>**, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of **<<1,200 square feet>>** at a mounting height of **<<9 feet>>**, with a field of view of 360 degrees.

3. Ultrasonic Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of **500 square feet** at a mounting height of **9 feet**, with a field of view of **360 or 180 degrees as indicated on the drawings**.
b. Medium Range Sensors: Capable of detecting motion within an area of **1,000 square feet>>** at a mounting height of **9 feet**, with a field of view of 360 degrees.
c. Extended Range Sensors: Capable of detecting motion within an area of **2,000 square feet** at a mounting height of **9 feet**.

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of **450 square feet** at a mounting height of **9 feet**, with a field of view of **360 or 180 degrees as indicated on the drawings**.
b. Extended Range Sensors: Capable of detecting motion within an area of **1,200 square feet** at a mounting height of **9 feet**, with a field of view of 360 degrees.

5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of **<<450 square feet>>** at a mounting height of **<<9 feet>>**, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of **<<1,200 square feet>>** at a mounting height of **<<9 feet>>**.

F. Directional Occupancy Sensors:

1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.

a. Unless otherwise indicated or required to control the load indicated on drawings, provide **<<low voltage units, for use with separate compatible accessory power packs>>**.
b. Provide field selectable setting for disabling LED motion detector visual indicator.

2. Passive Infrared (PIR) Directional Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within a distance of **40 feet** at a mounting height of **10 feet**.
b. Long Range Sensors: Capable of detecting motion within a distance of **80 feet** at a mounting height of **10 feet**.
c. High Bay Sensors: Capable of detecting motion within a distance of **50 feet** at a mounting height of **30 feet**.

3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of **40 feet** at a mounting height of **10 feet**.

G. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: **Dual rated for 120/277 Vac.**
4. Load Rating: As required to control the load indicated on drawings.

H. Power Packs for Wireless Occupancy Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
2. Input Supply Voltage: **Dual rated for 120/277 Vac**.
3. Load Rating: As required to control the load indicated on drawings.
4. Provide auxiliary contact closure output **where indicated**.
5. Rated Life of Relay: **One million cycles**.

I. Accessories:

1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors **where indicated.**

2.3 DAYLIGHTING CONTROLS

A. Manufacturers:

1. Hubbell Control Solutions
2. Lutron Electronics Company, Inc
3. Sensor Switch Inc

4. WattStopper
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. System Description: Control system consisting of **photo sensors and compatible control modules and power packs, or relays as required for automatic control of load indicated according to available natural light capable of integrating with occupancy sensors and manual override controls**.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.

1. Sensor Type: **Filtered silicon photo diode**.
2. Sensor Range:

a. Indoor Photo Sensors: **5 to 100 footcandles (53.8 to 1,080 lx)**.
b. Outdoor Photo Sensors: **5 to 250 footcandles (53.8 to 2690 lx)**.
c. Atrium Photo Sensors: **200 to 2,500 footcandles (2150 to 2,6910 lx)**.
d. Skylight Photo Sensors: **1,000 to 6,000 footcandles (10,760 to 64,580 lx)**.
e. Open Loop Photo Sensors: **3 to 6,000 footcandles (32.3 to 64,580 lx)**.

3. Finish: **White unless otherwise indicated**.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to **50** ballasts.

E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
3. Control Capability:

a. Single Zone Switching Modules: Capable of controlling one programmable channel.
b. Multi-Zone Switching Modules: Capable of controlling up to **three** separately programmable channels.

F. Daylighting Control Switching Modules for Wireless Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.

2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
4. Control Capability: Capable of controlling one programmable channel.
5. Input Supply Voltage: **Dual rated for 120/277 Vac**.

G. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
3. Control Capability: Capable of controlling up to **three** separately programmable channels, with up to **50** ballasts per channel.
4. Dimming and Fade Rates: Adjustable from **5 to 60 seconds**.
5. Cut-Off Delay: Selectable and adjustable from **0 to 20 minutes**.
6. Output Voltage: Compatible with specified dimming ballasts.

H. Power Packs for Low Voltage Daylighting Control Modules:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
2. Input Supply Voltage: **Dual rated for 120/277 Vac**.
3. Load Ratings: As required to control the load indicated on drawings.

I. Accessories:

1. Where indicated, provide compatible accessory wall switches for manual override control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Any lighting control devices that are wet, moisture damaged, or mold damaged shall be rejected.

B. Verify that field measurements are as indicated.

C. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

D. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

E. Verify that final surface finishes are complete**, including painting**.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

G. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130**, including mounting heights specified in those standards unless otherwise indicated, except for mounting heights specified in those standards**.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: **Unless otherwise indicated, as follows:**

   a. Wall Switch Occupancy Sensors: **48 inches** above finished floor.
   b. In-Wall Time Switches: **48 inches** above finished floor.
   c. In-Wall Interval Timers: **48 inches** above finished floor.

2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate **3 inches** (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. **Do not use oversized wall plates in lieu of meeting this requirement.**

I. Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
2. Locate **ultrasonic and dual technology passive infrared/ultrasonic** occupancy sensors a minimum of **4 feet** from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Daylighting Control Photo Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

K. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

L. Unless otherwise indicated, install power packs for lighting control devices **above accessible ceiling or above access panel in inaccessible ceiling near the sensor location**.

M. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

N. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

O. Where indicated or required, provide cabinet or enclosure in accordance with Section **260533.16** for mounting of lighting control device system components.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of **directional occupancy sensors and outdoor motion sensors** to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on **passive infrared (PIR) and dual technology** occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes,

furniture, and window treatments that do not function properly as determined by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 COMMISSIONING

A. **See Section 019113 - General Commissioning Requirements for commissioning requirements.**

3.8 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect and Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of **lighting control devices**.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of **two hours** of training.
3. Instructor**: Manufacturer's authorized service representative**.
4. Location: **Mansfield, TX**.

END OF SECTION

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SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Load centers.

D. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

F. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include available fault current and dates of calculation, demonstrating compliance with NEC 110.3(B) and NEC 408.6.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards per manufacturer's instructions and NECA 407.

B. 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.

C. Handle carefully per manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
2. Panelboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).
2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
b. Panelboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Listed series ratings are not acceptable.

D. Provide available fault current field marking. Provide permanent field marking on each panelboard assembly indicating the available fault current and the short-circuit current

rating (SCCR) of the equipment. Provide label, or updated label, for existing equipment.

1. Calculation Reference: The available fault current value shall be taken from the approved electrical riser diagrams and one-line drawings.
2. Date of Calculation: The marking shall include the date of calculation, which shall correspond to the date of the signed and sealed drawings used for the fault current determination.

    a. Marking Requirements: Markings shall be legible, durable, and located on the front of the equipment in a readily visible position. “Available Fault Current: _____ Amps”
    b. “SCCR: _____ Amps”
    c. “Date of Calculation: _____”

E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H. Bussing: Sized per UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

    a. Indoor Clean, Dry Locations: Type 1.
    b. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.

    a. Provide wiring gutters sized to accommodate the conductors to be installed.

b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided per Section 264300, list and label panelboards as a complete assembly including surge protective device.

1. Provide SPD where indicated on the drawings, at service entrance panelboards of building with lightning protection, and emergency and legally required standby systems panelboards per NEC 700 and NEC 701.

M. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.

1. Ampere Rating: Not less than ampere rating of panelboard bus.
2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
3. Coil Voltage: As required for connection to control system indicated.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.

a. Use zero sequence ground fault detection method unless otherwise indicated.
b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

P. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

Q. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.
2. Sub-feed lugs.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Aluminum.
2. Ground Bus Material: Aluminum.

D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than ____ amperes.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.

    a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
4. Conductor Terminations:

    a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

B. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2) 14,000 rms symmetrical amperes at 480 VAC.

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:

a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

a. Provide the following field-adjustable trip response settings:

1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.

b. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
c. Provide communication capability where indicated: Compatible with system indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.

d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

8. Provide listed switching duty-rated circuit breakers with SWD marking for all branch circuits serving to light.
9. Provide listed high-intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:

    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work per NECA 1 (general workmanship).

B. Install products per manufacturer's instructions.

C. Install panelboards per NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances per manufacturer's instructions and NFPA 70.

E. Provide required support and attachment per Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed per Section 033000.

J. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding per Section 260526.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 262813 for fusible switches.

N. Where accessories are not self-powered, provide control power source as indicated, or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as directed.

Q. Set field-adjustable ground fault protection pickup and time delay settings as directed.

R. Provide filler plates to cover unused spaces in panelboards.

S. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also, provide for the following:

1. Emergency and night lighting circuits.
2. Fire detection and alarm circuits.

T. Identify panelboards per Section 260553.

U. Available Fault Current and SCCR Label Verification: Confirm markings prior to energization and update if system modifications alter available fault current values.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test per NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.

E. Ground Fault Protection Systems: Test per manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits. Provide panelboard schedules to match.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Fan speed controllers.

D. Receptacles.

E. Wall plates and covers.

F. Floor box service fittings.

G. Poke-through assemblies.

H. Access floor boxes.

I. Multioutlet Assemblies.

1.2 RELATED REQUIREMENTS

A. Section 096900 - Access Flooring.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

C. Section 260533.16 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

O. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.
2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.
3. Surge Protection Receptacles: Include information on status indicators.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Manufacturers:

1. Cooper Wiring Devices, a brand of Eaton: www.eaton.com
2. Hubbell Incorporated: www.hubbell.com/#sle.
3. Intermatic, Inc: www.intermatic.com/#sle.
4. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
5. Lutron: www.lutron.com
6. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
7. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: www.relocwiring.com/#sle.
8. Southwire Company. Thomas & Betts Corporation: www.tnb.com/#sle.
9. Thomas & Betts, a brand of ABB: electrification.us.abb.com
10. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
11. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

2.2 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in dwelling units.

E. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. Provide isolated ground receptacles for receptacles serving electronic cash registers.

I. Unless noted otherwise, do not use combination switch/receptacle devices.

J. For flush floor service fittings, use tile rings for installations in tile floors.

K. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.3 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

F. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

G. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.

2.4 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Control: Slide control type with slide on/off control.

C. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

D. Provide locator light, illuminated with load off.

E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.5 FAN SPEED CONTROLLERS

A. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.

1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.6 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

B. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
7. Illuminated Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; illuminated face or indicator light to indicate power is being supplied to receptacle; single or duplex as indicated on the drawings.

C. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

    a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

D. Dead Front GFCI Outlet

1. Dead front GFCI outlets shall comply with UL 943, UL 508, WC 596, NEMAWD1 and WD6, ANSI C-73, and CSA C22.2. Faceless and blank faces are synonymous with a dead front.
2. NEMA approved and compliant with NEC®, CA Title 24, and ASHRAE Energy Efficiency Standard 90.1
3. Feedthrough type, Self-Grounding
4. Rated 20 amperes at 125 volts.
5. Include LED indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

E. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

    a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
    b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.

2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.

F. Surge Protection Receptacles:

1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.

    a. Energy Dissipation: Not less than 240 J per mode.
    b. Protected Modes: L-N, L-G, N-G.
    c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.
    d. Diagnostics:

        1) Visual Notification: Provide indicator light to report functional status of surge protection.

2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Isolated Ground Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, with ground contacts isolated from mounting strap.

G. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.

H. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.

2.7 WALL PLATES AND COVERS

A. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard. Oversized or extra-deep plates shall not be used.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.

E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

F. Chrome Wall Plates: Smooth finish, chrome plated steel.

G. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

H. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

I. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

J. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

K. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.

2.8 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

B. Above-Floor Service Fittings:

1. Single Service Pedestal Convenience Receptacles:

a. Configuration: One standard convenience duplex receptacle.

2. Single Service Pedestal Communications Outlets:

a. Configuration: One 1 inch bushed opening.
b. Voice and Data Jacks: Provided by others.

3. Single Service Pedestal Furniture Feed:

a. Configuration: One 3/4 inch knockout.

4. Dual Service Pedestal Combination Outlets:

a. Configuration:

1) Power: One standard convenience duplex receptacle.
2) Communications: One 1 inch bushed opening.
3) Voice and Data Jacks: Provided by others.

b. Provide barrier to separate line and low voltage compartments.

C. Flush Floor Service Fittings:

1. Single Service Flush Convenience Receptacles:

a. Cover: Rectangular.
b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).

2. Single Service Flush Communications Outlets:

    a. Cover: Rectangular.
    b. Configuration: _____.
    c. Voice and Data Jacks: Provided by others.

3. Single Service Flush Furniture Feed:

    a. Cover: Rectangular.
    b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).

4. Dual Service Flush Combination Outlets:

    a. Cover: Rectangular.
    b. Configuration:

        1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
        2) Communications: _____.
        3) Voice and Data Jacks: Provided by others.

5. Dual Service Flush Furniture Feed:

    a. Cover: Rectangular.
    b. Configuration:

        1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
        2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).

6. Accessories:

    a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
    b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

7. Products:

    a. Hubbell Incorporated; _____: www.hubbell.com/#sle.

2.9 POKE-THROUGH ASSEMBLIES

A. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

B. Above-Floor Service Fittings:

1. Single Service Pedestal Convenience Receptacles:

a. Configuration: One standard convenience duplex receptacle.

2. Single Service Pedestal Communications Outlets:

a. Configuration: One 1 inch bushed opening.
b. Voice and Data Jacks: Provided by others.

3. Single Service Pedestal Furniture Feed:

a. Configuration: One 3/4 inch knockout.

4. Dual Service Pedestal Combination Outlets:

a. Configuration:

1) Power: One standard convenience duplex receptacle.
2) Communications: One 1 inch bushed opening.

b. Provide barrier to separate line and low voltage compartments.

5. Products:

a. Hubbell Incorporated; _____: www.hubbell.com/#sle.

C. Flush Floor Service Fittings:

1. Single Service Flush Convenience Receptacles:

a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).

2. Single Service Flush Communications Outlets:

a. Configuration: _____.
b. Voice and Data Jacks: Provided by others.

3. Accessories:

a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

2.10 ACCESS FLOOR BOXES

A. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 096900.

B. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 260519.

C. Configuration:

1. Power: Two standard convenience duplex receptacle(s).
2. Voice and Data Jacks: Provided by others.

2.11 DEVICE COLORS

A. Wiring Devices Connected to Normal Power System: [Almond][Black][Brown] [Gray][Ivory][White][As selected by Architect] unless otherwise indicated or required by NFPA70 or device listing.

B. [Wiring Devices Connected to Emergency Power System: Red.]

C. TVSS Devices: [Blue]

D. Isolated-Ground Receptacles: [**Orange**][**As specified above, with orange triangle on face**].

E. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work per NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

    a. Wall Switches: 48 inches (1200 mm) above finished floor.
    b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
    c. Fan Speed Controllers: 48 inches (1200 mm) above finished floor.
    d. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices per manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect the wiring device grounding terminal to the branch circuit equipment grounding conductor and to the outlet box with the bonding jumper.

H. For isolated ground receptacles, connect the wiring device grounding terminal only to the identified branch circuit isolated equipment grounding conductor. Do not connect the grounding terminal to the outlet box or normal branch circuit equipment grounding conductor.

I. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding poles on top and horizontally mounted receptacles with grounding poles on the left.

O. Install wall plates to fit completely flush to the wall with no gaps and rough opening completely covered without strain on the wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

R. Provide non-feedthrough-type GFCI receptacles where protection of downstream receptacles is not required.

S. Provide feedthrough type faceless GFCI outlets for not readily accessible receptacles. Faceless GFCI outlets must be located in a readily accessible location.

T. Identify each device per Section 260553 – Identification for Electrical Systems.

U. Clearly label each receptacle and outlet with the corresponding panelboard identification and circuit number. Utilize hot-stamped or engraved machine printing with lettering filled in [black][, white][, or red] on the face of the plate. Inside outlet boxes, use durable wire markers or tags.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation, voltage, and proper polarity. Confirm line voltage between 108 and 132 volts, under no load conditions.

D. Verify ground impedance values 2 ohms or less.

E. Test each GFCI receptacle for proper tripping operation according to the manufacturer's instructions and conformance with UL 1436 and UL 943.

F. Inspect each surge protection receptacle to verify surge protection is active.

G. Verify the retention force of the grounding blade of hospital grade receptacles per NFPA 99, and confirm that the force is 4 ounces or greater. This includes receptacles in patient rooms.

H. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

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SECTION 262813
FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section **260553 - Identification for Electrical Systems**: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section **013000 - Administrative Requirements**, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section **016000 - Product Requirements**, for additional provisions.
2. Extra Fuses: **Three** set(s) of three for each type and size installed.
3. Fuse Pullers: **Two** set(s) compatible with each type and size installed.
4. Spare Fuse Cabinet Keys: **Two**.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum **three** years experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation.

B. Edison Fuse, Inc:

C. Ferraz Shawmut, Inc:

D. Littelfuse, Inc.

E. Mersen.

2.2 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: **Class CC, time-delay**.

D. Primary Protection for Control Transformers: **Class CC, time-delay**.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Class L Fuses: Comply with UL 248-10.

J. Class T Fuses: Comply with UL 248-15.

K. Class CC Fuses: Comply with UL 248-4.

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Provide the following accessories where indicated or where required to complete installation:

1. Fuseholders: Compatible with indicated fuses.
2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: << Manufacturer's standard, factory applied grey finish>> unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated>>.

D. Identify spare fuse cabinet in accordance with Section **260553**.

END OF SECTION

SECTION 262816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

J. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of circuit breaker.

B. Manufacturer's Installation Instructions: Indicate 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. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed circuit breakers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet (2,000 m).
2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide electronic trip circuit breakers where indicated.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

    a. Indoor Clean, Dry Locations: Type 1.
    b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
3. Provide surface-mounted enclosures unless otherwise indicated.

L. Provide externally operable handle with means for locking in the OFF position.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.

    a. Use zero sequence ground fault detection method unless otherwise indicated.
    b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
    c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:

1. Provide mechanical lugs unless otherwise indicated.
2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1. Provide the following field-adjustable trip response settings:

a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
b. Long time delay.
c. Short time pickup and delay.
d. Instantaneous pickup.
e. Ground fault pickup and delay where ground fault protection is indicated.

2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
3. Provide communication capability where indicated: Compatible with system indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:

1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.

J. Provide the following features and accessories where indicated or where required to complete installation:

1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment per Section 260529.

E. Install enclosed circuit breakers plumb.

F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

H. Provide grounding and bonding per Section 260526.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable circuit breaker tripping function settings as directed.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

3.3 FIELD QUALITY CONTROL

A. Inspect and test per manufacturer's instructions and NETA ATS, except Section 4.

1. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and circuit breakers larger than 800 amperes. Tests listed as optional are not required.

B. Ground Fault Protection Systems: Test per the manufacturer's instructions as required by NFPA 70.

C. Test GFCI circuit breakers to verify proper operation.

D. Test shunt trips to verify proper operation.

E. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match the original factory finish.

END OF SECTION

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SECTION 262816.16
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262813 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Identify mounting conditions required for equipment seismic qualification.

C. Manufacturer's equipment seismic qualification certification.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty or as indicated; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.

D. Unless otherwise indicated, provide products suitable for continuous operation under the service conditions at the project site.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Minimum Ratings:

a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
b. General Duty Single Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
c. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
d. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

I. Provide with switch blade contact position that is visible when the cover is open.

J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

K. Conductor Terminations: Suitable for use with the conductors to be installed.

L. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

N. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

P. Heavy Duty Switches:

1. Comply with NEMA KS 1.
2. Conductor Terminations:

a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

a. Provide means for locking handle in the ON position.

Q. Provide the following features and accessories where indicated or where required to complete installation:

1. Hubs: As required for environment type; sized to accept conduits to be installed.
2. Integral fuse pullers.

3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Provide required seismic controls in accordance with Section 260548.

F. Install enclosed switches plumb.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 260526.

I. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Identify enclosed switches in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 263213
ENGINE GENERATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:

1. Engine and engine accessory equipment.
2. Alternator (generator).
3. Generator set control system.
4. Generator set enclosure.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 231123 - Facility Natural-Gas Piping.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. The latest editions, including all revisions, of the following:

1. NECA 1 - Standard for Good Workmanship in Electrical Construction.
2. NECA/EGSA 404 - Standard for Installing Generator Sets.
3. NEMA MG 1 - Motors and Generators.
4. NFPA 30 - Flammable and Combustible Liquids Code.
5. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
6. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
7. **NFPA 110 - Standard for Emergency and Standby Power Systems.**
8. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries.
9. UL 2200 - Stationary Engine Generator Assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.

    a. **Transfer Switches: See Section 263600.**
    b. **Paralleling Low Voltage Switchgear: See Section 263213.**

2. Coordinate the work with other trades to avoid placing ductwork, piping, equipment, or other potential obstructions within the spaces dedicated to the engine generator system.
3. Coordinate the arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the auxiliary equipment and accessories to be installed.
5. Notify the Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
6. Coordinate the size and location of concrete bases for package engine generators and remote radiators mounted on grade. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
7. **Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators.**

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.5 SUBMITTALS

A. See Division 01 and Section 260500 – Common Work Results for Electrical, Communications, and Electronics Safety and Security Systems for submittal procedures.

B. Product Data: Provide the manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include kilowatt ratings, reactance, alternator starting capabilities, engine fuel consumption rates and cooling, combustion air, generator efficiency ratings, and airflow and exhaust requirements.

1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices upon request.
3. Include alternator thermal damage curve upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system (power, signal, and control) interconnection schematic diagrams showing all factory and field connections.

1. Identify mounting conditions required for equipment seismic qualification.
2. Identify weight of generator dry, and weight of generator wet.
3. Identify drain port locations and drain port clearances requirements.

D. Manufacturer's equipment seismic qualification certification.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Manufacturer's factory emissions certification.

G. Source quality control test reports.

H. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:

1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

I. Maintenance contracts.

J. Operations and Maintenance Manuals

1. The Operations Manual must include, at minimum, the following:

a. Step-by-step procedures for system startup, operation, and shutdown
b. Drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems with their controls, alarms, and safety systems
c. Procedures for interface and interaction with related systems to include automatic transfer switches, fire alarm/suppression systems, load shedding systems, and uninterruptible power supplies.

2. The Maintenance Manuals must include, at minimum, the following:

a. Procedures for each routine maintenance item.
b. Procedures for troubleshooting.
c. Factory-service, take-down overhaul, and repair service manuals, with parts lists.
d. The manufacturer's recommended maintenance schedule.
e. A component list that includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components.
f. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.6 QUALITY ASSURANCE

A. Comply with the latest editions of the following:

1. ASME B11.19

2. NFPA 30 (Flammable and Combustible Liquids Code).
3. NFPA 70 (National Electrical Code).
4. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
5. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

C. Installer Qualifications: Representative trained and authorized by the manufacturer

1. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project

D. Manufacturer Qualifications: A qualified manufacturer. Maintain a service center capable of providing training, parts, and emergency maintenance repairs within **four** hours' normal travel time of the project site.

E. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for the intended use.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. 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.

C. Protect and prepare batteries for shipment as recommended by the battery manufacturer.

D. Store auxiliary equipment at the site in covered enclosures, protected from atmospheric moisture, dirt, and ground water

E. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

F. During installation, cap piping and similar openings to keep out dirt and other foreign matter

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from the date of the system's initial start-up and shall include repair parts, labor, reasonable travel expenses necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair.

B. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Warranty coverage of less than 500 hours a year of operation will not be accepted. Submittals received without written warranties as specified will be rejected in their entirety.

C. The warranty shall include a temporary generator set in the event a warrantable repair will take more than 48 hours. The selling dealer must have a minimum of 10 units in its rental fleet to ensure a temporary unit is available if needed, or agreements with local generator rental agencies. Provide documentation as such.

D. Warranty shall have no deductible and include costs of all generator consumable products needed for repair.

E. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Packaged Engine Generator Set:
   1. **Generac Power Systems: www.generac.com/industrial/#sle. Basis of Design.**
   2. Caterpillar Inc: www.cat.com/#sle.
   3. Cummins Power Generation Inc: www.cumminspower.com/#sle.
   4. **Kohler Co: www.kohlerpower.com/#sle.**
   5. **MTU Onsite Energy, a Brand of Rolls-Royce Power Systems: www.mtuonsiteenergy.com/#sle.**

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. 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.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

D. The generator supplier shall have a minimum of six service technicians within 120 miles of the job site. They shall be available 24 hours a day year-round for emergencies

2.2 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:

1. Application: **Emergency/standby.**
2. Configuration: **Single packaged engine generator set operated independently (not in parallel)**.
3. EPA Emissions Tier Rating **4** and local government requirements.

D. Site Conditions

1. Protect the components of the engine-generator set, including cooling system components, pumps, fans, and similar auxiliaries when not operating, and provide components capable of the specified outputs in the following environment:

   a. Site Location: Address shown on project drawings
   b. Site Elevation: Sea Level to the altitude of the generator installation
   c. Ambient Temperatures: **41 to 110 Deg F (5 to 44 Deg C)**.

E. Packaged Engine Generator Set:

1. Type: **Natural Gas**.
2. Power Rating: **500 kW**.
3. Voltage: As indicated on drawings.
4. Main Line Circuit Breaker:

   a. Provide a generator-mounted 100% rated molded case circuit breaker, NEMA 1/IP22. The breaker shall utilize a solid-state trip unit and be connected to engine/generator safety shutdowns.
   b. The circuit breaker shall be housed in an extension terminal box isolated from vibrations induced by the generator set. Mechanical-type lugs sized for the circuit breaker feeders shown on the drawing shall be supplied on the load side of the breaker.
   c. Features to include:

      1) Molded case thermal magnetic trip breaker sized for full unit output rating
      2) Neutral connection sized for full product ratings.
      3) Ground connection in the customer power wiring section.

4) Arc Energy Reduction Module for circuit breakers capable of being adjusted to 1200 ampere or greater. Arc Energy Reduction Module is not necessary if generator controller has this mode available.

F. Generator Set General Requirements:

1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
2. Factory-assembled, with components mounted on suitable base.
3. List and label engine generator assembly as complying with UL 2200.
4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

G. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

H. Starting and Load Acceptance Requirements:

1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
4. Maximum Load Step: Supports 100 percent of rated load in one step.

I. Exhaust Emissions Requirements:

1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

J. Sound Level Requirements:

1. Comply with applicable local noise level regulations.
2. Do not exceed the following dBA when measured at property line **which is approximately 500 feet away from the generator**.

   a. 50 dBA for residential housing, camping, picnicking, health services, hotels, and educational services.
   b. 65 dBA for retail, business, and government services, automobile parking, retail trade, airports.

c. 75 dBA manufacturing, industrial, fairgrounds, amusement parks, agricultural, and forestry activities.

2.3 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Gaseous (Spark Ignition):

1. Fuel Source: Natural gas.
2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:

    a. Carburetor.
    b. Gas pressure regulators.
    c. Fuel shutoff control valves.
    d. Low gas pressure switches.

C. Engine Starting System:

1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):

    a. Battery Type: Lead-acid.
    b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
    c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.

3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:

    a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
    b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
    c. Recognized as complying with UL 1236.
    d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
    e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
    f. Provide alarm output contacts as necessary for alarm indications.

D. Engine Speed Control System (Governor):

1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:

1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.

F. Engine Cooling System:

1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.

G. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

H. Engine Jacket Water Heater:

1. Factory installed jacket water heater for increased cold starting capability.
2. Self-circulating
3. Sized per NFPA 110, Level 1 Requirements
4. Designed to operate at **208v**, single phase.

2.4 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:

1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

2.5 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:

1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:

    a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
    b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
    c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
    d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
    e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
    f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
    g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.

3. Generator Set Status Indications:

    a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    b. Current (Amps): For each phase.
    c. Frequency (Hz).
    d. Real power (W/kW).
    e. Reactive power (VAR/kVAR).
    f. Apparent power (VA/kVA).
    g. Power factor.
    h. Duty Level: Actual load as percentage of rated power.
    i. Engine speed (RPM).
    j. Battery voltage (Volts DC).
    k. Engine oil pressure.
    l. Engine coolant temperature.
    m. Engine run time.
    n. Generator powering load (position signal from transfer switch).

4. Generator Set Protection and Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, systems including but not limited to the following protections/indications:

1) Overcrank (shutdown).
2) Low coolant temperature (warning).
3) High coolant temperature (warning).
4) High coolant temperature (shutdown).
5) Low oil pressure (warning).
6) Low oil pressure (shutdown).
7) Overspeed (shutdown).
8) Low fuel level (warning).
9) Low coolant level (warning/shutdown).
10) Generator control not in automatic mode (warning).
11) High battery voltage (warning).
12) Low cranking voltage (warning).
13) Low battery voltage (warning).
14) Battery charger failure (warning).

b. In addition to NFPA 110 requirements, provide the following protections/indications:

1) High AC voltage (shutdown).
2) Low AC voltage (shutdown).
3) High frequency (shutdown).
4) Low frequency (shutdown).
5) Overcurrent (shutdown).
6) Fuel tank leak (warning), where applicable.

c. Provide contacts for local and remote common alarm.
d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:

a. Event log.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2. Generator Set Status Indications:

a. Generator powering load (via position signal from transfer switch).
b. Communication functional.

3. Generator Set Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, systems including but not limited to the following indications:

1) Overcrank (shutdown).
2) Low coolant temperature (warning).
3) High coolant temperature (warning).
4) High coolant temperature (shutdown).
5) Low oil pressure (shutdown).
6) Overspeed (shutdown).
7) Low fuel level (warning).
8) Low coolant level (warning/shutdown).
9) Generator control not in automatic mode (warning).
10) High battery voltage (warning).
11) Low cranking voltage (warning).
12) Low battery voltage (warning).
13) Battery charger failure (warning).
14) Ground Fault Indication (warning).

(a) Display ground fault indication upon ground fault at generator circuit breaker or emergency distribution circuit breakers. Provide relays, contacts, and control conductors between the remote annunciator and circuit breakers.

b. Provide audible alarm with silence function.
c. Provide lamp test function that illuminates all indicator lamps.

2.6 GENERATOR SET ENCLOSURE

A. Enclosure Type: Level 3 sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Utilize an upward discharging radiator hood.

J. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

K. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

L. Provide a grated working platform at the height of the base fuel tank, along the length of the generator set enclosure, and in front of the controls. This is required when the generator disconnects, or controls are positioned more than five feet above the ground with the base fuel tank.

2.7 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:

1. Operation at rated load and rated power factor.
2. Single step load pick-up.
3. Transient and steady state voltage and frequency performance.
4. Operation of safety shutdowns.

D. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

E. **Notify the owner and engineer a minimum of 14 calendar days prior to factory testing to allow owners representative to observe the tests.**

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work per NECA 1 (general workmanship).

B. Install products per manufacturer's instructions.

C. Install generator sets and associated accessories per NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch (150 mm) high concrete pad constructed per Section 033000.

F. Provide required support and attachment per Section 260529.

G. Use the manufacturer's recommended oil and coolant, suitable for the worst-case ambient temperatures.

H. **Provide natural gas piping per Section 231123.**

I. Provide grounding and bonding per Section 260526.

J. Identify system wiring and components per Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Division 01 for quality requirements.

B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

C. Notify authorities having jurisdiction and follow their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load banks and fuel.

E. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.
2. Verify that the tightness of mechanical and electrical connections is according to the manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.

F. Testing

1. Prepare and start the system per the manufacturer's instructions. Record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period
2. Perform acceptance test per the following:

    a. Perform tests recommended by the manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters. Generators shall be tested individually and in parallel.

b. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.

3. Provide field emissions testing where necessary for certification.
4. Load Testing:

a. Increase the load in steps no greater than the Maximum Step Load Increase to 100 percent of the Service Load and operate the engine generator set for at least 30 minutes.
b. Remove load and shut down the engine-generator set after the recommended cool-down period
c. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.
d. Test the engine generator under 100 percent load for at least 4 hours.

5. Battery Tests: Equalize charging of battery cells according to the manufacturer's written instructions.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within the manufacturer's specifications.

6. Battery-Charger Tests: Verify specified charge rates for equalizing and float-charging conditions.
7. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of the engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
8. Exhaust Emissions Test: Comply with applicable government test criteria to confirm adherence to EPA Tier rating.
9. Voltage and Frequency Transient Stability Tests: Use a recording oscilloscope to measure voltage and frequency transients for 50% and 100% step-load increases and decreases and verify that performance is as specified.
10. Harmonic-Content Tests: Measure harmonic content of output voltage under 25% and at 100% of rated linear load. Verify that harmonic content is within specified limits.
11. “Pull the Plug Test”: Automatic start-up by means of simulated power outage to test remote-automatic starting, load transfer, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level, along with generator set voltage, amperes, and frequency, shall be monitored throughout the test.

G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than or equal to 1000 amperes. Tests listed as optional are not required.

H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions and as required by NFPA 70 sections 110.3(B), 230.95(C), and 240.13.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

I. Arc Energy Reduction Testing: Test by primary current injection.

J. Coordinate tests with tests for transfer switches and run them concurrently

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests

L. Correct defective work, adjust for proper operation, and retest until the entire system complies with Contract Documents.

M. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met

N. The engine generator-set manufacturer must furnish a qualified representative to supervise the installation of the engine generator-set, assist in the performance of the on-site tests, and instruct personnel on the operational and maintenance features of the equipment.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators, load bank and associated paralleling gear operations.

B. Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Acceptance: Submit drawings which accurately depict the as-built configuration of the installation, upon acceptance of the engine-generator set installation. Revise layout drawings to reflect the as-built conditions and submit them with the as-built drawings. Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and all defects in installation material or operation have been corrected

3.6 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.7 MAINTENANCE

A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, parts, adjustment, inspection, and testing, including testing under load, with a detailed schedule.

B. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within 4 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

C. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

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SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 262300 - Low-Voltage Switchgear.

C. Section 262413 - Switchboards.

D. Section 262416 - Panelboards.

E. Field-mounted SPDs for 120 to 600 V power distribution and control equipment.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2019).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
2. UL 1283 (for Type 2 SPDs).

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Field-Installed, Externally Mounted Surge Protective Devices:

1. Advanced Protection Technologies, APT: www.apt-power.com/power-system-products/surge-protection/
2. Current Technology, ABB: www.electrification.us.abb.com/#sle.
3. Eaton: www.eaton.com
4. Intermatic, Inc: www.intermatic.com/#sle.
5. nVent ERICO: www.nvent.com/#sle.
6. Schneider Electric: www.se.com/#sle.
7. Siemens Industry, Inc; www.siemens.com
8. Southern Tier Technologies (formerly Liebert Surge Suppression)
9. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

C. Source Limitations: Provide surge protective devices produced by single manufacturer and obtained from single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.
2. Delta Systems: L-G, L-L.
3. Single Split Phase Systems: L-N, L-G, N-G, L-L.
4. High Leg Delta Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
4. 480V Delta System Voltage: Not more than 1,800 V for L-G mode and 3,000 V for L-L mode.
5. 600Y/347V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,500 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.
2. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Switchgear: See Section 262300.
2. Switchboards: See Section 262413.
3. Panelboards: See Section 262416.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

7. Diagnostics:

    a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
    d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 3,500 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

    a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

7. Diagnostics:

    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.

b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.5 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

   a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

7. Diagnostics:

   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

8. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Provide SPD for NEC 700 Emergency and NEC 701 Legally Required systems switchgear, switchboards, and panelboards.

C. Install products in accordance with manufacturer's instructions.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

F. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

G. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

H. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

I. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

F. LED replacement lamps.

G. LED retrofit luminaire conversion kits.

H. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260500 - Common Work Results for Electrical, Communications, and Electronic Safety and Security Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260923 - Lighting Control Devices.

E. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2020.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

P. UL 1993 - Self-Ballasted Lamps and Lamp Adapters; Current Edition, Including All Revisions.

Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, energy-efficiency data, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
4. Air Handling Luminaires: Include air handling performance data.
5. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.
6. Provide wiring diagrams including power, signal, and control wiring.
7. Nonstandard or Custom Lighting Fixtures: Include plans, sections, elevations, and details including:

a. Dimensions, weight, required clearances, assembly instructions, components, field connection locations and sizes.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Lamps: Furnish (10) units for every (100) of each type and rating installed. Furnish (1) of each type minimum.
3. Diffusers and Lenses: Furnish (1) unit for every (100) of each type and rating installed. Furnish (1) of each type minimum.
4. Fixture mounted emergency battery pack: Furnish (1) unit for every (20) of each type and rating installed. Furnish (1) of each type minimum.
5. Drivers: Furnish (1) for every (20) of each type and rating installed. Furnish (1) of each type minimum.
6. Guards and Globes: Furnish (1) unit for every (20) of each type and rating installed. Furnish (1) of each type minimum.

H. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

D. Provide 3-year manufacturer warranty for LED replacement lamps.

E. Provide 3-year manufacturer warranty for LED retrofit luminaire conversion kits.

PART 2 - PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Manufacturers:

1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
2. Alloy LED; _____: www.alloyled.com/#sle.
3. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
4. Current Lighting, HLI Brands: www.currentlighting.com/brands
5. Elite Lighting: iuseelite.com/
6. Hubbell Lighting, Inc; _____: www.hubbelllighting.com/#sle.
7. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
8. Philips Lighting North America Corporation; _____: www.lightingproducts.philips.com/#sle.
9. RAB Lighting, Inc; _____: www.rablighting.com/#sle.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

J. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:

a. Listed.
b. Designed for field cutting in accordance with listing.
c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2. White LED Tape:

a. Correlated Color Temperature (CCT): _____ K unless otherwise indicated.
b. Color Rendering Index (CRI): Not less than 90.

L. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EMERGENCY LIGHTING UNITS

A. Manufacturers:

1. Acuity Brands, Inc; _____: www.acuitybrands.com/#sle.
2. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.
3. Hubbell Lighting, Inc; _____: www.hubbelllighting.com/#sle.

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.

I. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.4 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

1. Manufacturers:

a. Acuity Brands, Inc; _____: www.acuitybrands.com/#sle.
b. Cooper Lighting, a division of Cooper Industries; _____: www.cooperindustries.com/#sle.

c. Hubbell Lighting, Inc; _____: www.hubbelllighting.com/#sle.
d. Philips Lighting North America Corporation; _____: www.lightingproducts.philips.com/#sle.

2. Self-Powered Exit Signs:

a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
b. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
c. Provide low-voltage disconnect to prevent battery damage from deep discharge.
d. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.5 BALLASTS AND DRIVERS

A. Manufacturers:

1. Alloy LED; _____: www.alloyled.com/#sle.
2. California Accent Lighting, Inc; _____: www.calilighting.com/#sle.
3. General Electric Company/GE Lighting; _____: www.gelighting.com/#sle.
4. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
5. OSRAM Sylvania, Inc; _____: www.osram.us/ds/#sle.
6. Philips Lighting North America Corporation; _____: www.usa.lighting.philips.com/#sle.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.

B. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
4. Rated driver life shall match LED luminaire estimated useful life.

C. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

a. Wall Dimmers: See Section 262726.
b. Daylighting Controls: See Section 260923.

c. Network Lighting Controls: See Section _____.

3. Product(s):

a. Lutron Hi-Lume Premier 0.1% Constant Voltage (L3D0-Series): 3-wire and digital control; 0.1 percent dimming with Soft-On and Fade-to-Black low end performance; www.lutron.com/#sle.
b. Lutron Hi-Lume 1% (LTE-Series): Forward phase (neutral wire required); one percent dimming; www.lutron.com/#sle.
c. Lutron Hi-Lume 1% (L3D-Series): 3-wire and digital control; one percent dimming; www.lutron.com/#sle.
d. Lutron 5-Series (LDE5-Series): Digital control; five percent dimming; www.lutron.com/#sle.
e. Lutron Hi-lume 1% Soft-on Fade-to-Black (LDE1-Series): Digital control; one percent dimming with Soft-On and Fade-to-Black low end performance; www.lutron.com/#sle.

2.6 LAMPS

A. Manufacturers:

1. General Electric Company/GE Lighting; _____: www.gelighting.com/#sle.
2. Osram Sylvania; _____: www.sylvania.com/#sle.
3. Philips Lighting North America Corporation; _____: www.usa.lighting.philips.com/#sle.
4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. Lamps - General Requirements:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.7 LED REPLACEMENT LAMPS

A. Manufacturers:

1. RAB Lighting, Inc; _____: www.rablighting.com/#sle.

B. Description: Light-emitting diode (LED) self-ballasted lamps listed as complying with UL 1993; intended for replacement of existing lamps of other light source types, including but not limited to, incandescent, fluorescent, and high intensity discharge (HID); suitable for installation in luminaire to be retrofitted.

C. LED Estimated Useful Life:

1. Calculated based on IES LM-80 test data.
2. Fluorescent Lamp Replacements: Minimum of 50,000 hours at 70 percent lumen maintenance.
3. High Intensity Discharge (HID) Lamp Replacements: Minimum of 50,000 hours at 70 percent lumen maintenance.
4. Incandescent Lamp Replacements: Minimum of 15,000 hours at 70 percent lumen maintenance.

2.8 LED RETROFIT LUMINAIRE CONVERSION KITS

A. Manufacturers:

1. OSRAM Sylvania, Inc; www.osram.us/ds/#sle.
2. RAB Lighting, Inc; www.rablighting.com/#sle.

B. Description: Light-emitting diode (LED) retrofit luminaire conversion kits, including but not limited to LED lamps and arrays, control modules, drivers, power supplies, wiring, lampholders, brackets, wire connectors, reflectors, and diffusers, intended for replacement of existing light sources in existing luminaires; listed as complying with UL 1598C; suitable for installation in luminaire to be converted.

2.9 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. Verify the distance between remote driver and fixture does not exceed that recommended by the manufacturer.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 260529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.
6. Provide anti-sway brackets for pendant supports longer than 4 feet to limit swinging.
7. Provide support at each end of each fixture chassis for fixtures installed in a continuous row.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

M. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 233600.

N. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

O. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

P. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.9 ATTACHMENTS

A. Luminaire schedule. (Refer to drawings)

END OF SECTION

SECTION 284600
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Performance based specification.

B. Fire alarm system design and installation, including all components, wiring, and conduit.

C. Transmitters for communication with supervising station.

D. Circuits from protected premises to supervising station, including conduit.

E. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

F. Maintenance of fire alarm system under contract for specified warranty period.

1.2 RELATED REQUIREMENTS

A. Section **078400 - Firestopping**: Materials and methods for work to be performed by this installer.

B. Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.

C. Section **087100 - Door Hardware**: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

D. Section **149100 - Facility Chutes**: Sensors and interlocks monitored by fire alarm system.

E. Section **211300 - Fire-Suppression Sprinkler Systems**: Supervisory, alarm, and actuating devices installed in sprinkler system.

F. Section **233300 - Air Duct Accessories**: Smoke dampers monitored and controlled by fire alarm system.

1.3 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. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities; 2020.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 601 - Standard for Security Services in Fire Loss Prevention; 2020.

I. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section **013000 - Administrative Requirements**, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
3. Certification by Contractor that the system design will comply with Contract Documents.
4. Proposed maintenance contract.

C. Drawings must be prepared using AutoCAD Release.

1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. Copy (if any) of list of data required by authority having jurisdiction.
2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.

5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming .
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations. Voice amplification power capacity calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including finish selections, wiring diagrams, installation instructions, and circuit length limitations.
9. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements.
10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
11. Detailed drawing of graphic annunciator(s).
12. System input/output matrix.
13. Detailed locations and information of duct detectors including:

    a. Detailed plans of duct detectors shown with duct work. Include sections and elevations. Show placement and support of sampling tubes, detector housing, remote status and test devices.
    b. Listed air velocity, humidity, and temperature. Coordinate and verify range is compatible with air handling system.
    c. Show field wiring. Include HVAC shutdown, Firefighter control and smoke evacuation system (if applicable)

14. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
15. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
16. Certification by Contractor that the system design complies with Contract Documents.
17. Do not show existing components to be removed.

F. <<Manufacturer's equipment seismic qualification certification.>>

G. Evidence of installer qualifications.

H. Evidence of instructor qualifications; training lesson plan outline.

I. Evidence of maintenance contractor qualifications, if different from installer.

J. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

K. Operating and Maintenance Data: See Section 017800 for requirements; have one set available during closeout demonstration:

1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. Contact information for company that will be providing contract maintenance and trouble call-back service.
5. List of recommended spare parts, tools, and instruments for testing.
6. Replacement parts list with current prices, and source of supply.
7. Detailed troubleshooting guide and large scale input/output matrix.
8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

L. Project Record Documents: See Section 017800; Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, addresses, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications and addresses.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

M. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

N. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. See Section **016000 - Product Requirements**, for additional provisions.
2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data<< and place in spare parts cabinet>>.
3. <<In addition to the items in quantities indicated in PART 2, furnish>><<Furnish>> the following:

    a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes

to system description, operation, and evacuation and instructional messages.
b. One copy, on CD-ROM, of all software not resident in read-only-memory.
c. Extra Fuses: **Two** for each installed fuse; store inside applicable control cabinet.

1.5 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 50 miles (80 km) of project site.
5. Certified or Licensed in the State in which the Project is located as fire alarm installer.

D. Maintenance Contractor Qualifications: Same entity as installer.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 WARRANTY

A. See Section **017800 - Closeout Submittals**, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 5 years after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 5 Year after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:

1. Honeywell Security & Fire Solutions/Gamewell-FCI
2. Honeywell Security & Fire Solutions/Fire-Lite
3. Honeywell Security & Fire Solutions/Notifier
4. Honeywell Security & Fire Solutions/Silent Knight
5. Honeywell Security & Fire Solutions/Vista
6. National Time & Signal
7. Potter Electric Signal Company
8. Siemens Building Technologies, Inc
9. Simplex, a brand of Johnson Controls
10. Bosch Security Systems, Inc.
11. Fike Corporation
12. Mircom technologies

B. Initiating Devices and Notification Appliances:

1. Honeywell Security & Fire Solutions/Gamewell-FCI
2. Honeywell Security & Fire Solutions/Fire-Lite
3. Honeywell Security & Fire Solutions/Notifier
4. Honeywell Security & Fire Solutions/Silent Knight
5. Honeywell Security & Fire Solutions/Vista
6. National Time & Signal
7. Potter Electric Signal Company
8. Siemens Building Technologies, Inc
9. Simplex, a brand of Johnson Controls
10. Bosch Security Systems, Inc.
11. Fike Corporation
12. Mircom technologies
13. System Sensor
14. Wheelock, a brand of Eaton
15. Federal Signal Corporation
16. Gentex Corporation
17. Same manufacturer as control units.
18. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

C. Substitutions: **<<See Section 016000 - Product Requirements>><<Not permitted>>**.

1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.

2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: **4th Floor.**
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

    a. ADA Standards.
    b. The requirements of the State Fire Marshal.
    c. The requirements of the local authority having jurisdiction**.**
    d. Applicable local codes.
    e. Contract Documents (drawings and specifications).
    f. NFPA 101.
    g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability**.**
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone, unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone for response to assist in evacuation.
8. Program notification zones and voice messages as directed by Owner.
9. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
10. Master Fire Alarm Control Unit: Existing, located on the first floor
11. Two-Way Telephone: Provide two-way telephone service for the use of the fire service; provide jacks and <<two portable handsets>><<permanently mounted handsets>>.
12. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. <<Supervising Stations and Fire Department Connections>><<Fire Department Connections>>:

1. Public Fire Department Notification: **<<By on-premises supervising station>><<By remote supervising station>><<By new auxiliary fire alarm system approved by authority having jurisdiction>><<Via existing system>><<Manually activated public fire alarm box located at _____>>**.
2. On-Premises Supervising Station: <<Existing>><<New>> proprietary station operated by Owner, located at _____.
3. On-Premises Supervising Station: None.
4. Remote Supervising Station: <<Existing>><<New>> proprietary station operated by Owner, located at _____.
5. Remote Supervising Station: UL-listed central station under contract to facility.
6. Means of Transmission to On-Premises Supervising Station: <<Directly connected noncoded system>><<Digital alarm communicator transmitter (DACT)>><<2 telephone lines>><<Digital alarm communicator transmitter (DACT), _____>><<Two-way radio frequency (RF) multiplex>><<One-way private radio alarm transmitter>><<Private microwave radio transmitters>>.
7. Means of Transmission to Remote Supervising Station: <<Digital alarm communicator transmitter (DACT), 2 telephone lines>><<Digital alarm communicator transmitter (DACT), _____>><<Two-way radio frequency (RF) multiplex>><<One-way private radio alarm transmitter>><<Directly connected noncoded system>><<Private microwave radio transmitters>><<Cellular DACT>>.
8. Auxiliary Connection Type: << Local energy>><<Shunt type>><<or Parallel telephone>>.

C. Circuits:

1. Initiating Device Circuits (IDC): <<Class B, Style A>><<Class B, Style B>><<Class B, Style C>><<Class A, Style D>><<Class A, Style E>>.
2. Signaling Line Circuits (SLC)<< Within Single Building>>: <<Class B, Style 0.5; Class B, Style 1>><<Class A, Style 2>><<Class B, Style 3>><<Class B, Style 3.5>><<Class B, Style 4>><<Class B, Style 4.5>><<Class A, Style 5>><<Class A, Style 6>><<Class A, Style 7>>.
3. Signaling Line Circuits (SLC)**<< Between Buildings>>**: **<<Class A, Style 2>><<Class A, Style 5>><<Class A, Style 6>><<Class A, Style 7>>**.
4. Notification Appliance Circuits (NAC): <<Class B, Style W>><<Class B, Style X>><<Class B, Style Y>><<Class A, Style Z>>.
5. Limit SLC addressable devices to 50 per circuit.

D. Spare Capacity:

1. Initiating Device Circuits: Minimum <<25>><<50>> percent spare capacity.
2. Notification Appliance Circuits: Minimum <<25>><<50>> percent spare capacity.
3. Speaker Amplifiers: Minimum <<25>><<50>> percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

4. Each Computer System: Provide uninterruptible power supply (UPS).

2.3 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

C. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

D. Prior to starting work, perform a full test on the existing Fire Alarm System. Document and inform design team and Owner of any devices, components, or equipment not functioning as intended.

E. Do not interrupt existing fire alarm system serving operational facilities unless 7 days notice to architect and owner has been given and interruption has been approved by both architect and owner. Provide temporary guard service for the duration of interruption.

F. Protect all remaining devices during construction. Provide support for all cables, conduits, and junction boxes.

G. Clearly label components that are "Not In Service."

H. Remove unused existing components and materials from site and dispose of properly.

2.4 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
4. Sprinkler water storage tank low level.
5. Sprinkler water storage tank low temperature.
6. Fire pump(s).
7. Elevator shut-down control circuits.
8. Chute interlocks and controls.
9. Loss of communication with any panels, auxiliary systems, or communicators
10. Auxiliary system supervisory signals

B. Supervision Action: Provide these actions upon supervisory signal is activation

1. Initiate notification appliances

2. Display device identification and system status on fire alarm control unit and remote annunciators that initiated event
3. Record event in system memory
4. Transmit supervisory signal to central monitoring station after 200 seconds

C. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Manual stations
2. Flame detectors
3. Smoke detectors
4. Carbon Monoxide detectors
5. Air-Sampling smoke detection systems
6. Combustible gas detectors
7. Preaction system
8. Fire standpipe system
9. Fire pump running
10. Sprinkler water flow
11. Total flooding suppression system activation
12. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment
13. Elevator lobby, elevator hoist way, and elevator machine room smoke detectors
14. Generator room heat detector
15. Duct smoke detectors

D. Alarm action: Provide these actions upon alarm signal activation

1. Operate notification appliances continuously
2. Display device identification and system status on fire alarm control unit and remote annunciators that initiated event
3. Transmit alarm signal to central monitoring station
4. Release electronic door locks in egress path
5. Release magnetic door holds on fire and smoke doors
6. Set HVAC equipment to fire alarm mode
7. Activate fire fighters smoke-control panel
8. Initiate stairwell and elevator shaft pressurization fans
9. Close designated smoke dampers
10. Record event in system memory
11. Initiate Preaction system
12. Activate emergency lighting control
13. Recall elevator to primary/alternate floors afterwards, shunt trip power
14. Transmit supervisory signal to central monitoring station

E. Trouble:

1. Device circuit shorts, grounds, or open circuits
2. Signaling device, panel, or equipment tampering
3. Communication loss with addressable signaling, communication, or control devices
4. Loss of primary power for control or NAC panels
5. Control panel internal circuit breaks
6. Abnormal input voltage

7. Battery or battery charger failure
8. Voice amplifier failure
9. Abnormal switch positions at control panels or aunnuciators
10. Hose cabinet door open

F. Elevators:

1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

G. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

H. Doors:

1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section **087100**.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section **087100**.
3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section **083323**.

2.5 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: **<<Analog, addressable type>><<Conventional type>><<Conventional or addressable type>>**; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit:

1. General Requirements:

a. Complies with UL 864

b. Electronic modules that are field programmable, modular, and microprocessor based
c. Nonvolatile flash for system software and program storage
d. Real-time clock for event timestamping
e. Communicates with circuit panels and annunciators
f. Listed for communication connection to a central monitoring station
g. Nonvolatile memory for minimum 500 event history storage

2. Addressable initiation devices and control circuits for notification appliances and mechanical equipment. Control unit shall be listed for releasing service.
3. Include Alphanumeric display and system controls within control panel or directly at master control unit.
4. Include RS485, RS232, or USB ports when required for

a. Remote/central stations communicators
b. Remote annunciators, ethernet modules, or printers
c. VESDA HLI Communication
d. Voice evacuation controls
e. PC Configuration

D. Graphical Annunciators:

1. Panel: Graphical representation of building displaying detection locations and trouble and supervisory alarm conditions.

a. UL 864
b. Detector/alarm locations: red LED, Supervisory/trouble conditions: amber LED, Normal operation: Green LED
c. NEMA type 1 cabinet with 3/16 thick clear acrylic cover, lockable
d. Include regulated power supply, communications compatible with FACU, and lamp test

2. Workstation: Software based graphical representation of building displaying detection locations and trouble and supervisory alarm conditions.

a. Include event logging, report generation, address readouts
b. PC workstation should meet minimum software requirements per manufacturer.
c. PC should include UPS rated to maintain PC operations for 5 minutes and be on life safety circuit.
d. PC should include all necessary peripherals for operations. Monitor, Keyboard, Mouse, etc.

E. Remote Annunciators:

1. Match functions as FACU for controls and display. Include Alphanumeric display and indicating LEDS and controls for acknowledge, silence, test, and reset.

F. Addressable Modules:

1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
5. Releasing Control Modules: Provide as indicated or as required for control of listed solenoids in releasing applications.
6. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.

    a. Listed for use with fan motor controllers when used for HVAC controls
    b. When needed, provide relay controls for:

        1) Elevator recall initiation
        2) Initiate power shut down on shunt trip breakers
        3) Music or non-critical audio system sound mute/disable

7. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.
8. Products:

    a. Ruskin Company; ADC105 Addressable Damper Controller for Simplex Panels: www.ruskin.com/#sle.
    b. Substitutions: <<See Section 016000 - Product Requirements>><<Not permitted>>.

G. Initiating Devices:

1. Addressable Systems:

    a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
    b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

2. Manual Pull Stations:

    a. Finish: Red with molded, raised letters. Letters state operating instructions in contrasting color
    b. Mounting: Recessed or surface mounted with manufacture specific mounting box. Surface mounted stations indicated on drawings.
    c. Action: Single Action

d. Type: Pull lever
e. Addressable: Integral addressable module for alarm, trouble, and normal status communication.
f. Station Reset: Key or wrench operated switch
g. Shielding: Indoor protective shield with integral alarm
h. Comply with UL 38
i. Provide 1 extra

3. Smoke Detectors:

a. General Requirements:

1) Comply with UL 268
2) Four wire type with integral address module to communicate alarm, trouble, or normal status.
3) Mounting: Twist lock onto fixed base
4) Self Restoring: Resetting or readjustment not required after activation
5) Visual Indication: LED status lights for power and activation
6) Remote adjustable: Sensitivity adjustment by FACU.
7) Communicate calibration and sensitivity to FACU.
8) Provide 10% extra with at least one minimum.
9) Provide 2% extra with at least one minimum detector bases.

b. Provide Photoelectric smoke detectors

4. Duct Smoke Detectors:

a. Type: Photoelectric, complying with UL268A
b. Addressable with status access from fire alarm control panel. Status access shall include:

1) Primary Status
2) Devie Type
3) Present Average Value
4) Present Sensitivity Selected
5) Sensor Range (Normal, Dirty, etc.)

c. Housing: Weatherproof duct housing, NEMA250, Type 4X, NRTL listed for smoke detection in HVAC systems
d. Sensitivity Multi-level
e. Sampling Tubes: comply with manufacture recommendations for duct size, air velocity, and installation conditions.
f. Provide **10%** extra.

5. Heat Detectors:

a. General Requirements:

1) Comply with UL 521
2) Heat detectors shall be four wire type with integral address module to communicate alarm, trouble, or normal status.

3) Mounting: Twist lock onto fixed base
4) Self Restoring: Resetting or readjustment not required after activation
5) Visual Indication: LED status lights for power and activation
6) Remote adjustable: Sensitivity adjustment by FACU.
7) Communicate calibration and sensitivity to FACU.
8) Provide 10% extra with at least one minimum.
9) Provide 2% extra with at least one minimum detector bases.

b. Heat Detector: Combination type

10) Alarm actuation by a temperature rate-of-rise of 15 degrees Fahrenheit per minute or a fixed temperature above 135 degrees Fahrenheit or per drawings

c. Heat Detector: Fixed Temperature:

11) Alarm actuation by a fixed temperature above 190 degrees Fahrenheit or per drawings

H. Notification Appliances:

1. Horns:

a. Electric vibrating type horn, factory finished <<red>><<white>>
b. UL 464 tested
c. Provide 10% extra.

2. Speakers:

a. Voice notification speakers located per NFPA 72
b. UL 1480 listed
c. Low level output-1 to 2 Watts output
d. Factory finished Red
e. Provide 10% extra.

3. Strobes:

a. UL 1971 listed Xenon or LED Strobe light with factory engraved housing with 1” minimum letters. Devices designated for fire alarm only to have letters “FIRE” engraved. Devices designated for additional notification or mass notification systems along with fire alarm to have letters “ALERT” engraved
b. Field selectable light output between 15 and 110 candela, unless noted on drawings
c. Factory finished Red
d. Provide 10% extra.

4. Device Guards:

a. Include welded wire mesh that is color matched to device for device located in areas prone to physical damage.

I. Magnetic door holds

1. Electromagnetic door hold capable of up to 25-lbf holding force
2. **24-V AC/DC** rated
3. Match door hardware finish

J. Communication Modules

1. IPDACT: Provide Internet Protocol Digital Alarm Communication Transmitter

   a. Comply with NFPA 72 and UL 632
   b. Integral to FACU, an internal add on module, or external module
   c. Communicate all alarm, trouble, and supervisory events and corresponding information associated with signal.
   d. Supervised communication line

2. DACT: Digital Alarm Communication Transmitter:

   a. Comply with NFPA 72 and UL 632
   b. Integral to FACU, an internal add on module, or external module
   c. Communicate all alarm, trouble, and supervisory events and corresponding information associated with signal.
   d. Supervised communication line

3. Radio Alarm Transmitter

   a. Comply with NFPA 1225 and 47 CFR 90
   b. Coordinate with remote receiving station to determine operating frequency(s)

4. Network Communications

   a. Provide network communications. Include gateway for **BACnet** communications to building automation systems.

5. Cellular Network Communicator

   a. Comply with NFPA 72, UL 2610, UL 985, UL 864
   b. Dual SIM card, Dual cellular network capable.

K. Systems Printer

1. Provide dot-matrix printer compatible with FACU for system event recording.

L. Circuit Conductors:

1. Comply with NFPA 70
2. Primary and Secondary Backbone and IP communications: Copper or optical fiber; color code and label. Comply with section 271000
3. Signaling Line Circuits: Twisted Shielded Pair **18 AWG**

a. Circuit Integrity Cable: Class CI type FPL per NFPA 70, UL 1424 and UL 2196 two-hour rated

4. Non-Power-Limited Circuits:

a. Solid Copper, 600-V, 75 deg C rated
b. UL 2196 two-hour rated
c. Low Voltage Circuits: **16 AWG**
d. Line Voltage Circuits: **12 AWG**
e. Multiconductor Armored Cable: Type MC, TFN,THHN Conductors, Copper armor, jacketed. NRTL Listed for Fire Alarm, Plenum rated.

M. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 or 12 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 2 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

N. Locks and Keys: Deliver keys to Owner.

1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide **5** keys of each type
2. Provide a different standard lock and key for each key operated alarm initiating device; provide **25** keys of each type.

O. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.

1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

P. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.

1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

E. Existing System:

1. Verify and test existing fire alarm operation prior to making changes or connecting new devices.
2. Provide necessary modules, equipment, or devices to extend existing functions to new equipment.

F. Mounting: Wall mount cabinets with tops of cabinets located no more than 78 inches above finish floor.

G. Manual fire-alarm boxes:

1. Mount operable part at 48 inches above finish floor.
2. Provide manual fire-alarm boxes within 60 inches of exit doorway.

H. Smoke and Heat detector spacing:

1. Comply with NFPA 72 for spacing and installation.
2. Install detectors no closer than 60 inches from any air-supplies or return openings.
3. Install detector no closer than 12 inches or above any light fixtures.
4. Provide construction cover for detectors during construction. Remove prior to building turnover.
5. Duct detectors: Comply with NFPA 72 and 90A. Sample tubes to extend full length of duct. Support tubes over 36 inches on both ends.

    a. Provide remote status and test station, Label with machine printed label.

6. Air-Sampling Smoke detectors: Install sample piping according to manufacturer specifications for balanced air flow.
7. Elevator Shafts: Sprinkler shafts, do not provide smoke detectors. Coordinate heat detector ratings with sprinkler rating.

I. Pathways:

1. **Exposed conduit finish: Red**
2. Paint junction boxes and covers red

J. Cabling:

1. Comply with NFPA 70, 72 and NECA 1

2. Provide Plenum rated cable in environmental air spaces and plenum ceilings.
3. Cables and pathways associated with fire alarm system may not contain any other wire or cable
4. Provide two-hour rated fire alarm cables, NFPA 70 types CI and MI are acceptable
5. Provided numbered terminal strips for connections in junction boxes, cabinets, or equipment enclosures
6. Separate power-limited and non-power-limited conductors per manufacturer's recommendations
7. Bundle, lace, train cables and conductors with no excess
8. Make all connections with crimp on terminal spade lugs or plug connectors
9. Provide red jacketed cables

K. Identification:

1. System components, cabling, and terminals: Identify per Section 260553 "Identification for Electrical Systems"
2. Provide instructions for Fire Alarm Control Unit in visible location from FACU.

L. Grounding:

1. Comply with IEEE 1100. Provide ground wire for FACU and associated circuits to main grounding service.
2. Bond shielded cables at FACU ground only. Insulate shield at Device.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner **7 days** prior to beginning completion inspections and tests.

B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

F. Provide all tools, software, and supplies required to accomplish inspection and testing.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

H. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least **14 days** without any system or equipment malfunctions.

1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.3 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:

1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
6. Occupancy permit has been granted.
7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within **3 months** after <<Substantial Completion>><<date of occupancy>>.

3.4 MAINTENANCE

A. See Section **017000 - Execution and Closeout Requirements**, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for <<entire manufacturer's warranty period 2 years, to include the work described below.

C. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.

D. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

E. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within **2 hours** of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

F. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

G. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

H. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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ROCKWALL ISD
ROCKWALL NOC HVAC REFIT
ISSUE FOR CONSTRUCTION

SHEET LIST

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14 - MECHANICAL	
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M04-00	MECHANICAL NOC ROOM, ROOF AND GENERATOR PLANS
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E04-01	ENLARGED POWER PLANS AND DETAILS
E06-00	PANEL SCHEDULES

CODE INFORMATION

PROJECT DATA AND CODE INFORMATION

PROJECT DATA	
PROJECT NAME:	ROCKWALL NOC HVAC REFIT
PROJECT ADDRESS:	901 W Yellow Jacket Ln, Rockwall, TX 75087
OWNER:	ROCKWALL ISD

APPLICABLE CODES	
BUILDING CODE:	IBC 2021
ACCESSIBILITY CODE:	2012 Texas Accessibility Standards
ELECTRICAL CODE:	NEC 2020
ENERGY CODE:	ICC 2021
FIRE CODE:	IFC 2021
MECHANICAL CODE:	IMC 2021
PLUMBING CODE:	IPC 2021
REGIONAL OR MUNICIPAL CODE:	ENTER REGIONAL CODE
STORM SHELTER CODE:	ICC-500 2020

PROJECT TEAM

ARCHITECT
CORGAN
401 N. Houston St, Dallas, TX 75202
T: 214-748-2000

M E P
DUNHAM
2100 Lakeside Blvd. Suite 450 Richardson, Texas 75082
T: 469.694.5700

Deadline: March 31, 2026 - 2:30 PM

CORGAN
401 N. Houston St, Dallas, TX 75202
T: 214-748-2000

ISSUANCES

02/26/2026	ISSUE FOR CONSTRUCTION

REGISTERED ARCHITECT
BRIAN HANSBERGER SMITH
16318
STATE OF TEXAS

Date of issue:
02/26/2026

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ROCKWALL NOC HVAC REFIT
901 W Yellow Jacket Ln, Rockwall, TX 75087

JOB	26003.0000
DATE	02/26/2026

COVER SHEET

COVER

Deadline: March 31, 2026 - 2:30 PM

SHEET SYMBOLS

- NEW PARTITION
- EXISTING PARTITION
- DEMOLISHED PARTITION
- TEMPORARY PARTITION
- PARTIAL HEIGHT PARTITION
- DEMOLITION KEYNOTE (001)
- WINDOW TYPE IDENTIFICATION TAG (1)
- DOOR IDENTIFICATION TAG (101)
- ROOM NAME IDENTIFICATION TAG (Room name / 101)
- BATHROOM ACCESSORIES TAG (01)
- FINISH TYPE IDENTIFICATION TAG (Wall - N / Wall - W / Ceiling Finish / Floor Finish / Base Finish / Wall - E / Wall - S)
- PARTITION TYPE IDENTIFICATION TAG (A3-DA1)
- LOUVER TAG (L-1)
- GRID LINE IDENTIFICATION TAG (0)
- REVISION CLOUD AND IDENTIFICATION TAG (1)
- ELEVATION IDENTIFICATION TAG (LEVEL 100'-0")
- CEILING TAG (1' - 0")
- BREAK LINE
- CENTER LINE
- PROPERTY LINE (N 90 00' 00" E / Distance / 0' - 1")
- MATCHLINE
- EXTERIOR ELEVATION IDENTIFICATION TAG (1/ A101)
- INTERIOR ELEVATION IDENTIFICATION TAG (1/ A101)
- BUILDING SECTION IDENTIFICATION TAG (Ref / 01 / A101)
- WALL SECTION IDENTIFICATION TAG (Ref / 01 / A101)
- DETAIL REFERENCE TAG (1 / A101 / SIM)
- FIRE EXTINGUISHER CABINET

STANDARD ABBREVIATIONS

A.D.	AREA DRAIN
A.F.F. OR AFF	ABOVE FINISH FLOOR
A.P.	ACCESS PANEL
A/C.	AIR CONDITIONING
ABV.	ABOVE
ACOUS.	ACOUSTICAL
ACP	ACOUSTICAL CEILING PANEL
ACT	ACOUSTICAL CEILING TILE
ADD'L.	ADDITIONAL
ADJ.	ADJUSTABLE OR ADJACENT
AL.	ALUMINUM
ANCH.	ANCHOR
APPROX.	APPROXIMATE
ARCH.	ARCHITECTURAL
ASPH.	ASPHALT
ASS'Y.	ASSEMBLY
AUTO.	AUTOMATIC
AWC	ACOUSTICAL WALL PANELS
B.L.	BUILDING LINE
B.O.	BOTTOM OF
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BM.	BEAM
BOT.	BOTTOM
BRK.	BREAK
BRKT.	BRACKET
BSMT.	BASEMENT
BTWN.	BETWEEN
C.B.	CATCH BASIN
C.G.	CORNER GUARD
C.I.	CAST IRON
C.I.P	CAST IN PLACE
C.J.	CONTROL JOINT
C.O.	CLEAR OPENING
C.T.	CERAMIC TILE
CAB.	CABINET
CAT.	CATEGORY
CER.	CERAMIC
CFMF	COLD FORMED METAL FRAMING
CLG.	CEILING
CLO.	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CONTR.	CONTRACTOR
CORR.	CORRIDOR
CPT	CARPET
CPTT	CARPET TILE
CTR.	CENTER
CTRL.	CONTROL
D.F.	DRINKING FOUNTAIN
D.O.	DOOR OPENING
D.P.	DAMP PROOFING
D.S.	DOWNSPOUT
DBL.	DOUBLE
DEMO.	DEMOLITION
DEPT.	DEPARTMENT
DET. OR DTL.	DETAIL
DIA. OR DIAM.	DIAMETER
DIM.	DIMENSION
DISP.	DISPENSER
DN.	DOWN
DR	DOOR
DRN	DRAIN
DWG.	DRAWING
DWGS.	DRAWINGS

DWR.	DRAWER
E.	EAST
E.J.	EXPANSION JOINT
E.S.	EXPOSED STRUCTURE
E.W.	EACH WAY
E.W.C.	ELECTRIC WATER COOLER
EA.	EACH
EL. OR ELEV.	ELEVATION
ELEC. OR ELECT.	ELECTRICAL
EMERG. OR EMER.	EMERGENCY
ENCL	ENCLOSURE
EQ	EQUAL
EQUIP.	EQUIPMENT
EXIST.	EXISTING
EXP. OR EXPAN.	EXPANSION
EXT.	EXTERIOR
F.A.	FIRE ALARM
F.D.	FLOOR DRAIN
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
F.H.C.	FIRE HOSE CABINET
F.H.R.	FIRE HOSE REEL
F.HT.	FULL HEIGHT
F.O.C.	FACE OF CONCRETE
F.O.F.	FACE OF FINISH
F.O.S.	FACE OF STUD
F.S.	FULL SIZE
F.V.C.	FIRE VALVE CABINET
FDN.	FOUNDATION
FIN.	FINISH
FL. OR FLR.	FLOOR
FLASH	FLASHING
FLUOR.	FLUORESCENT
FPRF.	FIREPROOF(ING)
FR.	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FSTNR.	FASTENER
FT.	FOOT OR FEET
FTG.	FOOTING
FURR.	FURRING
FUT.	FUTURE
G.B.	GRAB BAR
G.C.	GENERAL CONTRACTOR
GA.	GAUGE
GALV.	GALVANIZED
GFRG	GLASS FIBER REINFORCED GYPSUM
GL.	GLASS
GND.	GROUND
GR.	GRADE
GRN	GRANITE
GSW	GYPSUM SHAFT WALL
GYP. BD.	GYPSUM BOARD
H.B	HOSE BIB
H.C.	HOLLOW CORE
H.K.	HOUSEKEEPING
H.M.	HOLLOW METAL
HCP.	HANDICAPPED
HD.	HAND
HDW. OR HDWR.	HARDWARE
HDWD.	HARDWOOD
HNDRL	HANDRAIL
HORZ.	HORIZONTAL
HR.	HOUR
HT.	HEIGHT
HVAC	HEATING, VENTILATION, AIR CONDITIONING
I.D.	INSIDE DIAMETER/DIMENSION
IN.	INCH
INCL.	INCLUDE(D)(ING)

INFO.	INFORMATION
INSUL.	INSULATION
INT.	INTERIOR
INV.	INVERT
JAN CLO.	JANITOR CLOSET
JAN.	JANITOR
JST.	JOIST
JT.	JOINT
L	LEG
LAB.	LABORATORY
LAM.	LAMINATE
LAV.	LAVATORY
LKR.	LOCKER
LT.	LIGHT
M.	METER
M.H.	MANHOLE
M.O.	MASONRY OPENING
MAS.	MASONRY
MATL.	MATERIAL
MAX.	MAXIMUM
MBL.	MARBLE
MECH.	MECHANICAL
MEMB.	MEMBRANE
MEP.	MECHANICAL, ELECTRICAL, PLUMBING
MFG.	MANUFACTURER
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
MTD.	MOUNTED
MTL.	METAL
MUL.	MULLION
N	NORTH
N.I.C.	NOT IN CONTRACT
N.T.S.	NO TO SCALE
NO.	NUMBER
NOM.	NOMINAL
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER/DIMENSION
OFF.	OFFICE
OPNG.	OPENING
OPP.	OPPOSITE
OPP.HD.	OPPOSITE HAND
OVHD.	OVERHEAD
OZ.	OUNCE
P.C.	PRECAST CONCRETE
P.LAM.	PLASTIC LAMINATE
PAV.	PAVING
PC.	PIECE
PL.	PLATE
PLAS.	PLASTIC
PLBG.	PLUMBING
PLYWD.	PLYWOOD
PMMP	PREMANUFACTURED METAL PANEL
PNT.	PAINT
POL.	POLISHED
PR.	PAIR
PRCST.	PRECAST
PREMANUF.	PREMANUFACTURED
PT.	POINT
PTD.	PAINTED
PTN.	PARTITION
R.	RADIUS
R.D.	ROOF DRAIN
R.O.	ROUGH OPENING
RCP	REFLECTED CEILING PLAN
REBAR	REINFORCING BAR

REF.	REFERENCE
REFG.	REFRIGERATOR
REINF.	REINFORCED
REQD.	REQUIRED
RESIL.	RESILIENT
REV.	REVISION
RFL.	REFLECTED
RM.	ROOM
S.	SOUTH
S.C.	SOLID CORE
S.H.	SPRINKLER HEAD
S.S.	STAINLESS STEEL
SAN.	SANITARY
SCHED. OR SCHD.	SCHEDULE
SEC.	SECURITY
SECT.	SECTION
SEW.	SEWER
SGL.	SINGLE
SHT.	SHEET
SHWR.	SHOWER
SIM.	SIMILAR
SPEC. OR SPECS.	SPECIFICATION(S)
SPKR.	SPEAKER
SQ.	SQUARE
SQ. FT. OR S.F.	SQUARE FOOT (FEET)
SQ. YD. OR S.Y.	SQUARE YARD(S)
STA.	STATION
STD.	STANDARD
STL.	STEEL
STOR.	STORAGE
STRUCT.	STRUCTURE OR STRUCTURAL
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
T&G	TONGUE & GROOVE
T.	TREAD
T. OR TEMP.	TEMPERED
T.O.C.	TOP OF CONCRETE
T.O.CMU	TOP OF CMU
T.O.D.	TOP OF DECK
T.O.O.	TOP OF
T.O.P.	TOP OF PARAPET
T.O.S.	TOP OF STEEL
T.O.S.S.	TOP OF STRUCTURAL SLAB
T.V.	TELEVISION
TEL.	TELEPHONE
THK.	THICK
TLT.	TOILET
TYP.	TYPICAL
U.N.O	UNLESS NOTED OTHERWISE
UNF.	UNFINISHED
UR.	URINAL
V.I.F.	VERIFY IN FIELD
VB.	VAPOR BARRIER
VERT.	VERTICAL
VEST.	VESTIBULE
W.	WEST OR WIDTH
W.B.	WEATHER BARRIER
W.C.	WATER CLOSET
W.P.	WATERPROOF
W/	WITH
W/O	WITHOUT
WD.	WOOD
WDW.	WINDOW
WR/GB	WATER RESISTANT GYP. BOARD
WSCT.	WAINSCOT
WT.	WEIGHT

ACCESSIBILITY NOTES

01 EXTERIOR ROUTE CONSTRUCTION

1. AN ACCESSIBLE ROUTE, IN THE DIRECTION OF TRAVEL, SHALL NOT HAVE A SLOPE EXCEEDING 1:20 (5/8" PER FOOT) EXCEPT AT A RAMP.
2. AN ACCESSIBLE ROUTE CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT).
3. ALL NEW PAVING AND WALKS FOR AN ACCESSIBLE ROUTE, SHALL NOT HAVE AN ABRUPT CHANGE IN SURFACE LEVEL (VERTICALLY) GREATER THAN 1/4" WHEN ABUTTING EITHER EXISTING OR OTHER NEW SURFACES DESIGNATED FOR AN ACCESSIBLE ROUTE.
4. AN ACCESSIBLE ROUTE CROSSING OR PARALLELING A HAZARDOUS AREA, SHALL BE CLEARLY MARKED IN A CONTRASTING COLOR, WITH THE ROUTE LOCATION, MARKING MATERIALS AND COLOR SHOWN ON THE DRAWING.
5. ANY OPENINGS THAT ARE CONSTRUCTED IN THE SURFACE OF AN ACCESSIBLE ROUTE SHALL HAVE THE OPENINGS RUNNING PERPENDICULAR TO THE DIRECTION OF TRAVEL WITH THE OPENINGS DIMENSION NOT TO EXCEED 1/2" IN THE DIRECTION OF TRAVEL.

02 CURB RAMPS

1. THE TOP AND BOTTOM OF THE RAMP, AT THE TRANSITION TO EITHER EXISTING OR NEW SURFACES, SHALL BE FLUSH AND FREE OF ANY ABRUPT VERTICAL CHANGES.
2. THE SURFACE FINISH OF THE RAMP, EITHER RAISED OR RECESSED AS PERMITTED BY ACCESSIBILITY CODES AND GUIDELINES, SHALL BE INSTALLED TO PERMIT WATER DRAINAGE.
3. THE RAMP CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT). SLOPE IN THE DIRECTION OF TRAVEL SHALL NOT EXCEED 1:12 (1" PER FOOT).

03 INTERIOR ROUTE CONSTRUCTION

1. AN ACCESSIBLE ROUTE, IN THE DIRECTION OF TRAVEL, SHALL NOT HAVE A SLOPE EXCEEDING 1:20 (5/8" PER FOOT), EXCEPT AT A RAMP.
2. AN ACCESSIBLE ROUTE CROSS SLOPE SHALL NOT EXCEED 1:48 (1/4" PER FOOT).
3. ALL NEW FLOOR CONSTRUCTION AND FLOORING MATERIALS SHALL NOT HAVE AN ABRUPT VERTICAL CHANGE IN FINISH SURFACE LEVEL GREATER THAN 1/4" WHEN ABUTTING EITHER EXISTING OR NEW SURFACES DESIGNATED FOR AN ACCESSIBLE ROUTE.

04 DOORS

1. ANY THRESHOLD SHALL NOT EXCEED 1/2" IN HEIGHT, NOR 1:2 SLOPE.
2. ALL ACCESSIBLE HARDWARE OPERABLE BY THE DISABLED, SHALL NOT EXCEED A HEIGHT OF 4'-0" AFF AND SHALL BE EASILY OPERATED WITH ONE HAND WITHOUT GRASPING, PINCHING OR TWISTING OF THE WRIST.
3. DOOR CLOSERS AND GATE CLOSERS SHALL BE ADJUSTED SO THAT FROM AN OPEN POSITION OF 90 DEGREES, THE TIME REQUIRED TO MOVE THE DOOR TO A POSITION OF 12 DEGREES FROM THE LATCH IS 5 SECONDS MINIMUM.
4. THE OPENING FORCE OF THE ALL ACCESSIBLE DOORS, EXCEPT FIRE EXIT DOORS, SHALL NOT EXCEED 5 POUNDS IN THE DIRECTION OF TRAVEL FOR EXITING.
5. THE OPERABLE HARDWARE ON A DOOR LEADING TO HAZARDOUS AREAS (E.G. BOILER ROOMS, MECHANICAL AND ELECTRICAL ROOMS, OTHER EQUIPMENT ROOMS, AND LOADING DOCK), SHALL HAVE A TEXTURED SURFACE ON THE TOUCHABLE AREA.

05 TOILET ROOMS

1. THE FLUSH CONTROL FOR ALL ACCESSIBLE TOILET/URINALS SHALL NOT EXCEED 3'-8" AFF, AND SHALL BE ON THE WIDE (APPROACH) SIDE OF THE TOILET.
2. ACCESSIBLE LAVATORIES SHALL HAVE ALL EXPOSED HOT WATER PIPING AND DRAIN PIPES EITHER INSULATED OR CONFIGURED TO PROTECT AGAINST SKIN CONTACT. THE UNDERSIDE OF THE LAVATORY SHALL NOT HAVE ANY SHARP OR ABRASIVE SURFACES.
3. ANY GRAB BAR INSTALLATION SHALL BE ABLE TO SUPPORT 250 POUNDS APPLIED IN ANY DIRECTION.

06 SIGNAGE

1. ALL ACCESSIBLE PERMANENT ROOMS AND SPACES, EXIT WAYS AND EXIT STAIRWAYS, SHALL HAVE SIGNAGE THAT MEETS ACCESSIBLE SIGNAGE REQUIREMENTS FOR LETTER SIZE, LETTER AND NUMBER TYPESTYLE, RAISED LETTERS, GRADE 2 BRAILLE, COLOR/CONTRAST, AND LOCATION.
2. ALL ACCESSIBLE TOILET ROOMS SHALL BE DESIGNATED WITH THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AND ACCESSIBLE TEXT SIGNAGE FOR A PERMANENT ROOM, PLACED DIRECTLY BELOW THE PICTOGRAM SYMBOL. THE SIGNAGE SHALL MEET THE ACCESSIBLE SIGNAGE REQUIREMENTS FOR LETTER SIZE, LETTER AND NUMBER TYPESTYLE, RAISED LETTERS, GRADE 2 BRAILLE, COLOR/CONTRAST, AND LOCATION.
3. ALL ACCESSIBLE PARKING SPACES AND PUBLIC ENTRANCES SHALL BE DESIGNATED WITH THE INTERNATIONAL SYMBOL OF ACCESSIBILITY SIGNAGE IN ADDITION TO ANY OTHER SIGNAGE REQUIRED FOR ACCESSIBILITY. THIS SIGNAGE SHALL MEET ACCESSIBILITY REQUIREMENTS FOR COLOR/CONTRAST AND LOCATION.

ACCESSIBLE MOUNTING HEIGHTS

	ADULT			SECTION
WATER CLOSET				
TOP OF SEAT	17"-19"			604.4
FLUSH CONTROLS	15" MIN-48" MAX			604.6/309.3/308
URINAL				
RIM OF BASIN	17" MAX.			605.2
FLUSH CONTROLS	15" MIN-48" MAX			604.6/309.3/308
LAVATORY/SINKS				
RIM OR COUNTER SURFACE	34" MAX.			606.3
APRON CLEARANCE	27" MIN.			306
KNEE CLEARANCE	27" MIN.			306.3
TOE CLEARANCE	9" MIN.			306.2
DRINKING FOUNTAIN				
SPOUT HEIGHT	36" MAX.			602.4
KNEE CLEARANCE	27" MIN.			306.3
TOE CLEARANCE	9" MIN			306.2
DRINKING FOUNTAIN (BENDING DISABLED)				
SPOUT HEIGHT	38"-43"			602.7
GRAB BARS				
TOP OF BAR	33" MIN-36" MAX			609.4
MIRROR				
BOTTOM OF REFLECTIVE SURFACE (above counters & lavs.)	40" MAX.			603.3
TOP OF REFLECTIVE SURFACE	74" MIN.			603.3
SHOWER STALL				
TOP OF SEAT	17" MIN-19" MAX			610.2
SHOWER SPRAY UNIT HEIGHT (FIXED)	48" MAX			608.6
SHOWER SPRAY UNIT HEIGHT (HAND HELD)	48" MAX			608.6
CONTROLS AND OPERATING MECHANISMS				
TOWEL DISPENSER	48" MAX.			308
SOAP DISPENSER	48" MAX.			308
HAND DRYER	48" MAX.			308
TOILET TISSUE DISPENSER	15"-48" MAX.			604.7
SANITARY NAPKIN DISPENSER/RECEPTACLE	48" MAX.			308
TOILET SEAT COVER DISPENSER	48" MAX.			308
ELECTRICAL DEVICES				
ELECTRICAL, PHONE AND DATA OUTLETS (TO CENTER)	17" MIN-46" MAX			308.2.1
ABOVE COUNTER OUTLETS (TO CENTER)	44" MAX.			308.2.2
LIGHT SWITCHES (HIGHEST OPERABLE PART)	48" MAX.			308
FIRE ALARM PULL (HIGHEST OPERABLE PART)	48" MAX.			308
THERMOSTATS (HIGHEST OPERABLE PART)	48" MAX.			308
FIRE EXTINGUISHER CAB. (T.O.HANDLE/OPER. DEVICE)	48" MAX.			308.3.1
PUBLIC TELEPHONE (TO HIGHEST OPERABLE PART)	48" MAX.			308
RAMPS AND STAIRS				
TOP OF HANDRAILS	34"-38"			505.4
ELEVATORS				
HALL CALL BUTTON	48" MAX			407.2.1.1/308
HALL LANTERNS	72" MIN			407.2.2.2
DRESSING AND FITTING ROOMS				
TOP OF BENCH	17" MIN-19" MAX			903.5
FOOD SERVICE LINES				
TOP OF TRAY SLIDE	28" MIN-34" MAX			904.5.2

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ISSUANCES

REGISTERED ARCHITECT HANSBERGER SMITH 16318 STATE OF TEXAS

Date of issue:
02/26/2026

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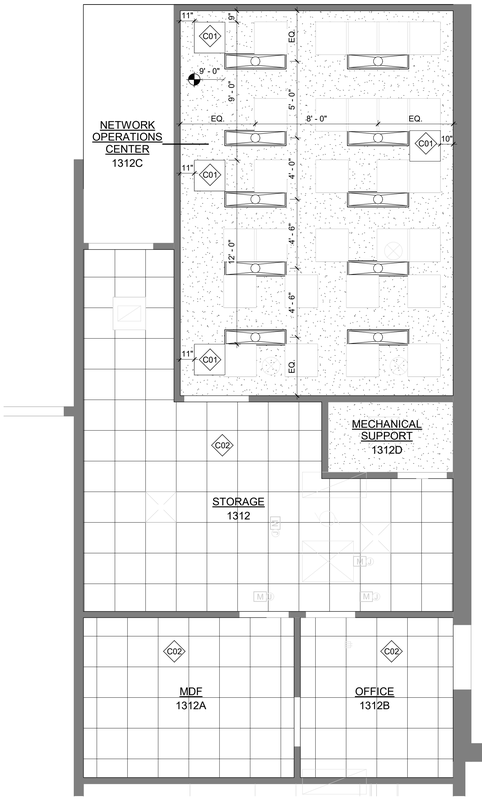
ROCKWALL NOC HVAC REFIT

901 W Yellow Jacket Ln, Rockwall, TX 75087

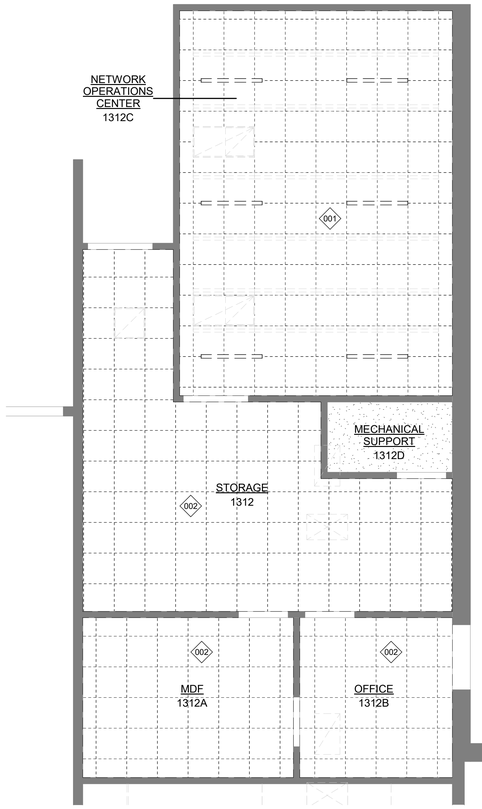
JOB 26003.0000
DATE 02/18/2026

STANDARDS AND SYMBOLS

.ARCH



02 ENLARGED REFLECTED CEILING PLAN - NETWORK OPERATIONS CENTER
1/4" = 1'-0"



01 ENLARGED DEMO REFLECTED CEILING PLAN - NETWORK OPERATIONS CENTER
1/4" = 1'-0"

GENERAL DEMO NOTES

1. REFER CONSULTANT DRAWINGS FOR FURTHER DETAIL REGARDING THE REMOVAL OF THOSE SCOPES.
2. CONTRACTOR TO NOTIFY ARCHITECT OF ANY DISCREPANCIES OR CONFLICTS IN INTENT TO ACCOMPLISHING ALL WORK ON PLAN AND THE COORDINATION OF THIS PLAN WITH ENGINEERING DRAWINGS OR IT WILL BE DEEMED THAT ALL NECESSARY WORK AND COST ARE INCLUDED.
3. EXISTING GENERATOR PAD TO BE DEMOLISHED AND REPLACED, REFER TO MEP FOR NEW PAD.
4. GENERATOR CURRENTLY SERVING NOC TO BE REMOVED, OTHER EXISTING GENERATOR IS TO REMAIN, REFER TO MEP.

GENERAL RCP NOTES

1. LOCATE CEILING MOUNTED FIXTURES / DEVICES IN THE CENTERS OF FULL CEILING PANELS/TILES U.N.O.
2. COORDINATE MEP / ETC. DRAWINGS FOR ALL FIXTURES / DEVICES MOUNTED IN, ABOVE, OR HUNG FROM CEILING. FINAL FIXTURE / DEVICE LOCATIONS ARE DETERMINED BY THE ARCHITECTURAL R.C.P. WHERE CONDITIONS DIFFER SIGNIFICANTLY BETWEEN THE PLANS, REQUEST CLARIFICATION FROM THE ARCHITECT BEFORE PROCEEDING. WHERE FIXTURES / DEVICES SHOWN OR SPECIFIED ON DRAWINGS OTHER THAN THE ARCHITECTURAL R.C.P.'S ARE VISIBLE AT THE CEILING PLANE. COORDINATE LOCATIONS WITH THE ARCHITECT.
3. FOR ACT CEILINGS, IF START POINT IS NOT PROVIDED ON PLANS, THEN IT IS INTENDED FOR THE ACT GRID TO BE CENTERED IN THE ROOM.

KEYNOTE LEGEND

001	REMOVE EXISTING CEILING AND LIGHTS. REFERENCE MEP FOR CEILING MOUNTED DEVICES TO BE DEMOLISHED OR SAVED FOR REINSTALLATION. ALL FIXTURES AND SERVICES THAT ARE TO BE REINSTALLED ARE TO BE STORED AND PROTECTED DURING CONSTRUCTION. PREP FOR NEW CEILING TO BE INSTALLED.
002	REMOVE EXISTING CEILING, SALVAGE EXISTING LIGHTS. REFERENCE MEP FOR CEILING MOUNTED DEVICES TO BE DEMOLISHED OR SAVED FOR REINSTALLATION. ALL FIXTURES AND SERVICES THAT ARE TO BE REINSTALLED ARE TO BE STORED AND PROTECTED DURING CONSTRUCTION. PREP FOR NEW CEILING TO BE INSTALLED AND SALVAGED LIGHTS TO BE REINSTALLED IN EXISTING LOCATIONS.
C01	2'x 2' ACCESS PANEL.
C02	REINSTALL SALVAGED LIGHTS TO MATCH EXISTING LOCATIONS.

RCP LEGEND

2X2 LAY-IN CEILING	GYP. BD. CEILING
1X4 LAY-IN LENS FIXTURE	SUPPLY AIR DIFFUSER
1' - 0" FINISHED CEILING HEIGHT A.F.F.	RETURN AIR DIFFUSER

CORGAN
401 N. Houston St, Dallas, TX 75202
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ISSUANCES

02/26/2026	ISSUE FOR CONSTRUCTION

REGISTERED ARCHITECT
HANSBERGER
16318
STATE OF TEXAS

Date of issue:
02/26/2026

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ROCKWALL NOC HVAC REFIT

901 W Yellow Jacket Ln, Rockwall, TX 75087

JOB	26003.0000
DATE	02/26/2026

ENLARGED DEMO/PROPOSED REFLECTED CEILING PLAN

A01-01

MECHANICAL ABBREVIATIONS

AD	AREA DRAIN	KW	KILOWATT
A.F.F.	ABOVE FINISHED FLOOR	LAT	LEAVING AIR TEMPERATURE
AFMS	AIR FLOW MEASURING STATION	LAV	LAVATORY
AHU	AIR HANDLING UNIT	LWT	LEAVING WATER TEMPERATURE
ANB	ACID NEUTRALIZING BASIN	MBH	BTU PER HOUR (THOUSANDS)
AP	ACCESS PANEL	MCF	THOUSAND CUBIC FEET
ARCH	ARCHITECT	MH	MANHOLE
AS	AIR SEPARATOR	MOD.	MODULATING
BD	BUTTERFLY DAMPER	NC	NOISE CRITERIA OR NORMALLY CLOSED
BDD	BACKDRAFT DAMPER		
B/G	BELOW GRADE	NEG	NEGATIVE
BTU	BRITISH THERMAL UNIT	NIC	NOT IN CONTRACT
BWV	BACKWATER VALVE	NO	NORMALLY OPEN
CCF	HUNDRED CUBIC FEET	NTS	NOT TO SCALE
CFH	CUBIC FEET PER HOUR	OA	OUTSIDE AIR
CFM	CUBIC FEET PER MINUTE	OBD	OPPOSED BLADE DAMPER
CL	CENTER LINE	ORD	OVERFLOW ROOF DRAIN
CLG	CEILING	PD	PRESSURE DROP OR DIFFERENCE
CO	CLEAN OUT	PE	PNEUMATIC-ELECTRIC
CONTR	CONTRACTOR	PLBG	PLUMBING
CONV	CONVECTOR	PRV	PRESSURE REDUCING VALVE OR POWER ROOF VENTILATOR
CUH	CABINET UNIT HEATER		
CW	COLD WATER	PSIA	POUNDS/SQ INCH ABSOLUTE
DB	DECIBEL	PSIG	POUNDS/SQ INCH GAUGE
DF	DRINKING FOUNTAIN	PVC	POLY VINYL CHLORIDE
DIA	DIAMETER	RA	RETURN AIR
DIFF	DIFFUSER	RCP	REINFORCED CONCRETE PIPE
DISCH	DISCHARGE	RD	ROOF DRAIN
DMPR	DAMPER	RECIRC	RECIRCULATING
DN	DOWN	REG	REGISTER
DR	DRAIN	RET	RETURN
DSN	DOWNSPOUT NOZZLE	RH	RELATIVE HUMIDITY
DWG	DRAWING	RH	ROOF HYDRANT
EAT	ENTERING AIR TEMPERATURE	RHT	REHEAT
EDR	EQUIVALENT DIRECT RADIATION	RHC	REHEAT COIL
EP	ELECTRIC-PNEUMATIC	RHW	RECIRCULATED HOT WATER
EWC	ELECTRIC WATER COOLER	RLF	RELIEF
EWT	ENTERING WATER TEMPERATURE	RM	ROOM
EXH	EXHAUST	RPM	REVOLUTIONS PER MINUTE
EXP	EXPANSION	RPZ	REDUCED ZONE BACKFLOW PREVENTER
F	FAHRENHEIT		
FC	FAN COIL	SA	SUPPLY AIR
FCO	FLOOR CLEAN OUT	SAN	SANITARY
FD	FLOOR DRAIN	SCFM	CFM, STANDARD CONDITIONS
FHC	FIRE HOSE CABINET	SD	SMOKE DAMPER
FHR	FIRE HOSE RACK	SP	STATIC PRESSURE
FLR	FLOOR	SPECS	SPECIFICATIONS
FLEX	FLEXIBLE	SUP	SUPPLY
FM	FIRE MAIN	SQ	SQUARE
FPM	FEET PER MINUTE	STM	STEAM
FPS	FEET PER SECOND	TD	TEMPERATURE DIFFERENCE
FT	FEET OR FOOT	TEMP	TEMPERATURE
F&T	FLOAT AND THERMOSTATIC	TONS	TONS OF REFRIGERATION
FTG	FOOTING	T-STAT	THERMOSTAT
FTR	FINNED TUBE RADIATION	TYP	TYPICAL
FV	FACE VELOCITY	UB	UP-BLAST
GA	GAUGE	UG	UNDERGROUND
GAL	GALLON	UH	UNIT HEATER
GEXH	GREASE EXHAUST	UR	URINAL
GPH	GALLONS PER HOUR	V	SANITARY VENT
GPM	GALLONS PER MINUTE	VAV	VARIABLE AIR VOLUME
GR	GRILLE	VD	VOLUME DAMPER
HB	HOSE BIBB	VEL	VELOCITY
HD	HEAD	VFD	VARIABLE FREQUENCY DRIVE
HOA	HANDS-OFF-AUTOMATIC	VOL	VOLUME
HTG	HEATING	VTR	VENT THROUGH ROOF
HTR	HEATER	W	SANITARY WASTE
HVAC	HEATING, VENTILATION, AND AIR CONDITIONING	W/	WITH
		W/O	WITHOUT
HYD	HYDRANT	WC	WATER CLOSET
HW	HOT WATER	WCO	WALL CLEANOUT
GCO	GRADE CLEANOUT	WH	WALL HYDRANT
INSUL	INSULATION	WTR	WATER
INV	INVERT	YCO	YARD CLEANOUT
ISO	ISOLATION EXHAUST	ZDL	ZERO DEADLEG VALVE

MECHANICAL SYMBOLS LEGEND

PLUMBING

SYMBOL	DESIGNATIONS
AV	ACID VENT
AW	ACID WASTE
CWV	CLEAR WATER VENT
CWW	CLEAR WATER WASTE
10#A	COMPRESSED AIR (PSI INDICATED)
DIS	DEIONIZED WATER SUPPLY
DIR	DEIONIZED WATER RETURN
CW	DOMESTIC COLD WATER
HW	DOMESTIC HOT WATER
140	DOMESTIC HOT WATER (TEMP. INDICATED)
RHW	DOMESTIC RECIRC. HOT WATER
140 RHW	DOM. RECIRC. HOT WATER (TEMP. INDICATED)
FW	FILTERED WATER
GW	GREASE WASTE
HARD	HARD COLD WATER
NPCW	NON-POTABLE COLD WATER
NPHW	NON-POTABLE HOT WATER
OSD	OVERFLOW STORM DRAIN
PAW	PUMPED ACID WASTE
PSD	PUMPED STORM
PW	PUMPED WASTE
RO	REVERSE OSMOSIS WATER
V	SANITARY VENT
W	SANITARY WASTE
SOFT	SOFTENED COLD WATER
SDT	SOIL DRAINAGE TILE
SHW	SOFTENED HOT WATER
SD	STORM DRAIN
TW	TEMPERED WATER
WW	WELL WATER

MECHANICAL PIPING

SYMBOL	DESIGNATIONS
ATM STM	ATMOSPHERIC STEAM SUPPLY
ATM SC	ATMOSPHERIC STEAM CONDENSATE
BF	BOILER FEED
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
CD	CONDENSATE DRAIN
CS	CONDENSER WATER SUPPLY
CR	CONDENSER WATER RETURN
FOS	FUEL OIL SUPPLY
FOR	FUEL OIL RETURN
FOF	FUEL OIL FILL
FOV	FUEL OIL VENT
GS	GLYCOL SUPPLY
GR	GLYCOL RETURN
HRS	HEAT RECOVERY SUPPLY
HRR	HEAT RECOVERY RETURN
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
IG	INTERRUPTIBLE GAS
LPG	LIQUIFIED PETROLEUM GAS
2#G	NATURAL GAS (PSI INDICATED)
PC	PUMPED CONDENSATE
RADS	RADIATION WATER SUPPLY
RADR	RADIATION WATER RETURN
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
RHG	REFRIGERANT HOT GAS BYPASS
RHS	REHEAT WATER SUPPLY
RHR	REHEAT WATER RETURN
RRS	REMOTE RADIATOR SUPPLY
RRR	REMOTE RADIATOR RETURN
SHWS	SECONDARY HEATING WATER SUPPLY
SHWR	SECONDARY HEATING WATER RETURN
SMS	SNOW MELT SUPPLY
SMR	SNOW MELT RETURN
10#STM	STEAM SUPPLY (PSI INDICATED)
10#SC	STEAM CONDENSATE (PSI INDICATED)

PIPE FITTINGS

SYMBOL	DESIGNATIONS
	CONNECTION, BOTTOM
	CONNECTION, TOP
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	ELBOW
	ELBOW DOWN
	ELBOW UP
	PIPE CAP
	PIPE FLANGE
	PIPE UNION
	TEE
	TEE, OUTLET UP
	TEE, OUTLET DOWN

PIPE SPECIALTIES

SYMBOL	DESIGNATIONS
	ALIGNMENT GUIDE
A	AUTOMATIC AIR VENT
	AUTOMATIC CONTROL VALVE, 2-WAY
	AUTOMATIC CONTROL VALVE, 3-WAY
	BACKWATER VALVE
	BALANCE VALVE
	CATCH BASIN
	DIAPHRAGM
	DRAIN ABOVE
	DRAIN VALVE
	DUPLEX STRAINER
	EXPANSION JOINT
	FLEXIBLE CONNECTION
	FLOOR DRAIN
	FLOOR SINK
	FLOW DIRECTION
	FLOW DIRECTION W/PITCH
FS	FLOW SWITCH
	GAS COCK VALVE
	GAS PRESSURE REGULATOR VALVE
HB	HOSE BIBB
	MANHOLE
M	MANUAL AIR VENT
	PIPE ANCHOR
	PRESSURE GAUGE W/PIGTAIL & PETCOCK
	PRESSURE REDUCING VALVE (SETTING AS NOTED, PSI)
	PRESSURE RELIEF/SAFETY VALVES(SETTING AS NOTED, PSI)
PS	PRESSURE SWITCH
	PRESSURE/TEMPERATURE TEST PORT
	PUMP
	REDUCED PRESSURE ZONE BACK FLOW PREVENTER
	REFRIGERANT DRYER
	REFRIGERANT SIGHT GLASS
	ROOF DRAIN
	STEAM TRAP (TYPE INDICATED)
	STRAINER
	STRAINER W/BLOWDOWN CAP AND VALVE
	THERMOMETER
	WALL CLEANOUT
WH	WALL HYDRANT
	WATER HAMMER ARRESTOR

GENERAL DUTY VALVES

SYMBOL	DESIGNATIONS
OR	BALL VALVE
OR OR	BUTTERFLY VALVE
	CHECK VALVE
	FLOW LIMITING VALVE
	GATE VALVE
	GLOBE ANGLE VALVE
OR	GLOBE VALVE
OR	O. S. & Y. VALVE
	PLUG VALVE
	SHUTOFF VALVE
	SOLENOID VALVE

DUCTWORK

SYMBOL	DESIGNATIONS
	SUPPLY AIR OR OUTDOOR AIR
	RETURN AIR
	EXHAUST AIR
	STANDARD BRANCH, NO SPLITTER - SUPPLY FLOW TO RIGHT - RETURN/EXHAUST FLOW TO LEFT
	BELLMOUTH WITH BALANCING DAMPER
	FLEXIBLE DUCT
	TURNING VANES
	FLEXIBLE CONNECTION
	MANUAL VOLUME DAMPER
	MOTORIZED DAMPER
AFMS	AIRFLOW MEASURING STATION
TYPE XXX XXX ORIENTATION	FIRE, SMOKE, AND COMBINATION FIRE/SMOKE DAMPERS TYPE: FD = FIRE DAMPER SD = SMOKE DAMPER FSD = COMBINATION FIRE/SMOKE DAMPER CRD = CEILING RADIATION DAMPER ORIENTATION: ◆ HORIZONTAL ▽ VERTICAL
XXX XXX ACTUATOR (AS APPLICABLE) BLADE/CURTAIN	
	SUPPLY GRILLE OR REGISTER
	RETURN OR EXHAUST GRILLE OR REGISTER
	SUPPLY DUCT UP, POSITIVE PRESSURE
	RETURN DUCT UP, NEGATIVE PRESSURE
	EXHAUST DUCT UP, NEGATIVE PRESSURE
	SUPPLY DUCT DN, POSITIVE PRESSURE
	RETURN DUCT DN, NEGATIVE PRESSURE
	EXHAUST DUCT DN, NEGATIVE PRESSURE
	SUPPLY DIFFUSER/REGISTER BLANKOFF INDICATED
	RETURN GRILLE/REGISTER
	EXHAUST GRILLE/REGISTER
	LINEAR DIFFUSER
	CONCENTRIC DUCT TRANSITION
	ECCENTRIC DUCT TRANSITION
	RECTANGULAR-TO-ROUND DUCT TRANSITION
	VAV BOX
	VAV BOX W/ REHEAT COIL
	REHEAT COIL
	VAV BOX W/ ELECTRIC REHEAT
	VAV BOX W/ DUCT SILENCER
	VAV BOX W/ DUCT SILENCER & REHEAT COIL
	VENTURI TYPE AIR VALVE
RISE DROP	DUCT OFFSETS
	DUCT CUTLINE

CONTROLS

SYMBOL	DESIGNATIONS
A	AQUA STAT
CO2	CARBON DIOXIDE SENSOR
CO	CARBON MONOXIDE SENSOR
DP	DIFFERENTIAL PRESSURE SENSOR
EM	ENERGY METER
GPM	FLOW METER
H	R.H. SENSOR WITH DIGITAL DISPLAY
NOX	NITROGEN OXIDE SENSOR
R	REFRIGERANT SENSOR
P P	ROOM PRESSURE MONITOR
SD	SMOKE DETECTOR
TS	SPACE TEMPERATURE SENSOR
SP PS	STATIC PRESSURE SENSOR
T	TAMPERPROOF THERMOSTAT
T	THERMOSTAT
T	THERMOSTAT W/GUARD
TS	TEMPERATURE SENSOR

FIRE PROTECTION

SYMBOL	DESIGNATIONS
TS	BUTTERFLY VALVE W/TAMPER SWITCH
	DETECTOR CHECK W/BYPASS METER
	DRY PIPE VALVE
FDV	FIRE DEPT VALVE W/CAP AND CHAIN
F	FIRE PROTECTION
DFP	FIRE PROTECTION (DRY SYSTEM)
	FIRE PROTECTION RISER
	FLUSH FIRE DEPT CONNECTION
	GRADE FIRE DEPT CONNECTION
TS	O.S. & Y. VALVE W/TAMPER SWITCH
	PENDANT SPRINKLER HEAD
	POST INDICATOR VALVE (PIV)
	PREACTION VALVE
FDVC	RECESSED FIRE DEPT CABINET
	SIDEWALL SPRINKLER HEAD
FDVC	SURFACE MOUNTED FIRE DEPT CABINET
	UPRIGHT SPRINKLER HEAD
	UPRIGHT SPRINKLER HEAD W/GUARD

ANNOTATION

12x12 / 12ø / 12/12	RECTANGULAR (WxH) / ROUND / FLAT-OVAL (W/H) — DUCT DIMENSIONS
(4)A-12"ø / 450	QUANTITY, TYPE, SIZE / CFM — GRILLE, REGISTER, & DIFFUSER IDENTIFICATION
TYPE FTR/RP 01 6'-5" / GPM 0.5	ACTIVE ELEMENT LENGTH — HYDRONIC FINNED TUBE RADIATION & RADIANT PANEL IDENTIFICATION
TYPE EBR 01 6'-5"	ACTIVE ELEMENT LENGTH — ELECTRIC BASEBOARD RADIATION IDENTIFICATION
	DETAIL NUMBER / SHEET NUMBER
	SECTION NUMBER / SHEET NUMBER
	EQUIP DESIGNATION / EQUIP NUMBER
XXXX #-##	EXISTING EQUIP NUMBER / EXISTING EQUIP DESIGNATION
	POINT OF CONNECTION, NEW TO EXISTING
	POINT OF DISCONNECTION

GENERAL

	LIGHT SOLID LINE WEIGHT INDICATES EXISTING ITEM TO REMAIN.
	DARK DASHED LINE WEIGHT INDICATES EXISTING ITEM TO BE DEMOLISHED.
	DARK SOLID LINE WEIGHT INDICATES NEW ITEM OR NEW LOCATION.

MECHANICAL SHEET LIST

SHEET NUMBER	SHEET NAME
MECH	MECHANICAL SYMBOLS AND ABBREVIATIONS
M00-00	MECHANICAL NOC ROOM, ROOF AND GENERATOR DEMOLITION PLANS
M04-00	MECHANICAL NOC ROOM, ROOF AND GENERATOR PLANS
M06-00	MECHANICAL AND ELECTRICAL SCHEDULES
M07-00	MECHANICAL CONTROLS DIAGRAMS
M08-00	MECHANICAL DETAILS
F04-01	FIRE PROTECTION NOC ROOM PLAN AND DETAILS

SHEET TOTAL: 7

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

CORGAN

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ISSUANCES

02/26/26	ISSUE FOR CONSTRUCTION

Date of issue:
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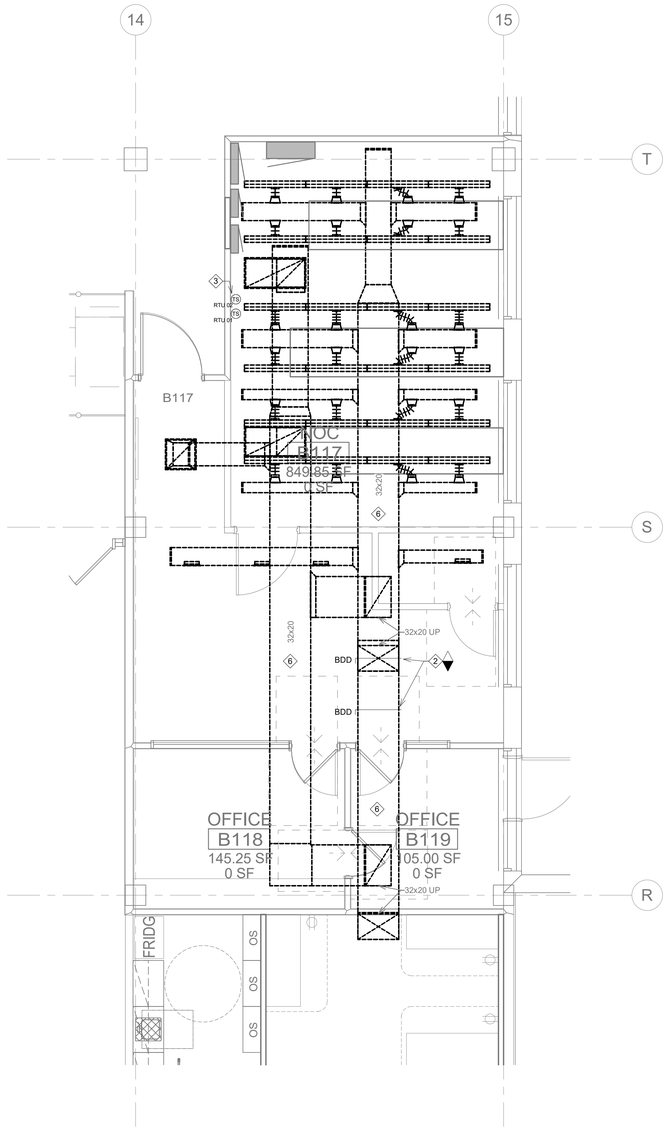
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ROCKWALL, TX 75087

JOB 1326013-000-00
DATE 02/26/26

MECHANICAL SYMBOLS AND ABBREVIATIONS

.MECH

2/26/2026 9:02:11 AM .MECH MECHANICAL SYMBOLS AND ABBREVIATIONS



1 MECHANICAL NOC ROOM DEMOLITION PLAN
1/4" = 1'-0"

2 MECHANICAL ROOF DEMOLITION PLAN
1/4" = 1'-0"

3 MECHANICAL GENERATOR DEMOLITION PLAN
1/4" = 1'-0"

GENERAL NOTES:

A. FIELD VERIFY ALL EXISTING CONDITIONS AND CONNECTION POINTS PRIOR TO BIDDING AND DETERMINE ACTUAL CONDITIONS. DISCREPANCIES BETWEEN EXISTING CONDITIONS AND MECHANICAL DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID SUBMITTAL.

B. MECHANICAL CONTRACTOR SHALL REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION. ANY CONFLICTS BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR INTERPRETATION.

C. WHERE MECHANICAL SYSTEMS ARE DAMAGED OR DISTURBED DURING DEMOLITION OR CONSTRUCTION, THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE TO REMOVE DAMAGED PORTIONS AND INSTALL NEW PRODUCTS OF EQUAL QUALITY AND FUNCTIONALITY.

D. DEMOLISH ALL MECHANICAL EQUIPMENT, PIPING, DUCTWORK, CONTROLS AND ACCESSORIES SHOWN AS DASHED ON THIS PLAN UNLESS NOTED OTHERWISE. DO NOT ABANDON DUCTWORK, HANGERS OR OTHER MATERIALS. PATCH DUCT MAINS WHERE A BRANCH IS REMOVED.

KEY NOTES:

1. DEMOLISH ROOFTOP UNIT. PREPARE CURB FOR ADDITION OF ADAPTER CURB AND NEW ROOFTOP UNIT.
2. DEMOLISH BACKDRAFT DAMPER FROM DUCT MAIN CONNECTION TO ROOTOP UNIT.
3. DEMOLISH TEMPERATURE SENSORS AND CONTROL WIRING SERVING ROOFTOP UNITS 01 AND 02.
4. DEMOLISH CONDENSATE PIPE ON ROOF.
5. PROVIDE PRE-DEMOLITION TEST AND BALANCE TO ESTABLISH SUPPLY AND RETURN AIRFLOW RATES.
6. DEMOLISH SUPPLY AND RETURN DUCTWORK BACK TO ROOFTOP UNIT.
7. DEMOLISH NATURAL GAS PIPING BACK TO SERVICE VALVE.

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

CORGAN

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ROCKWALL NOC HVAC REFIT

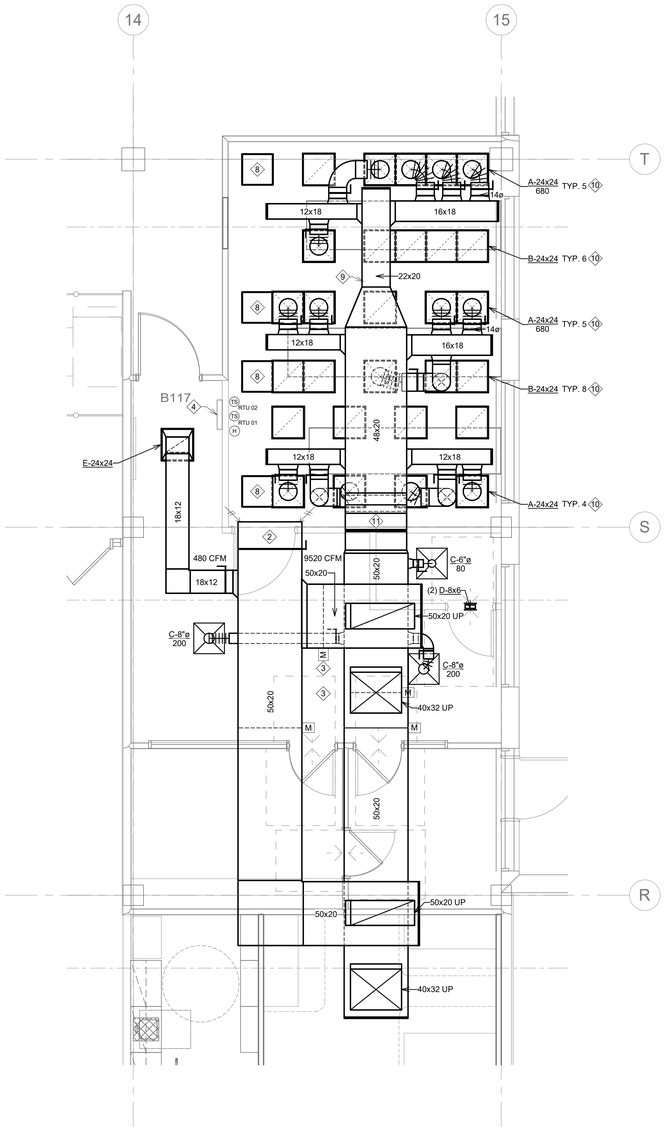
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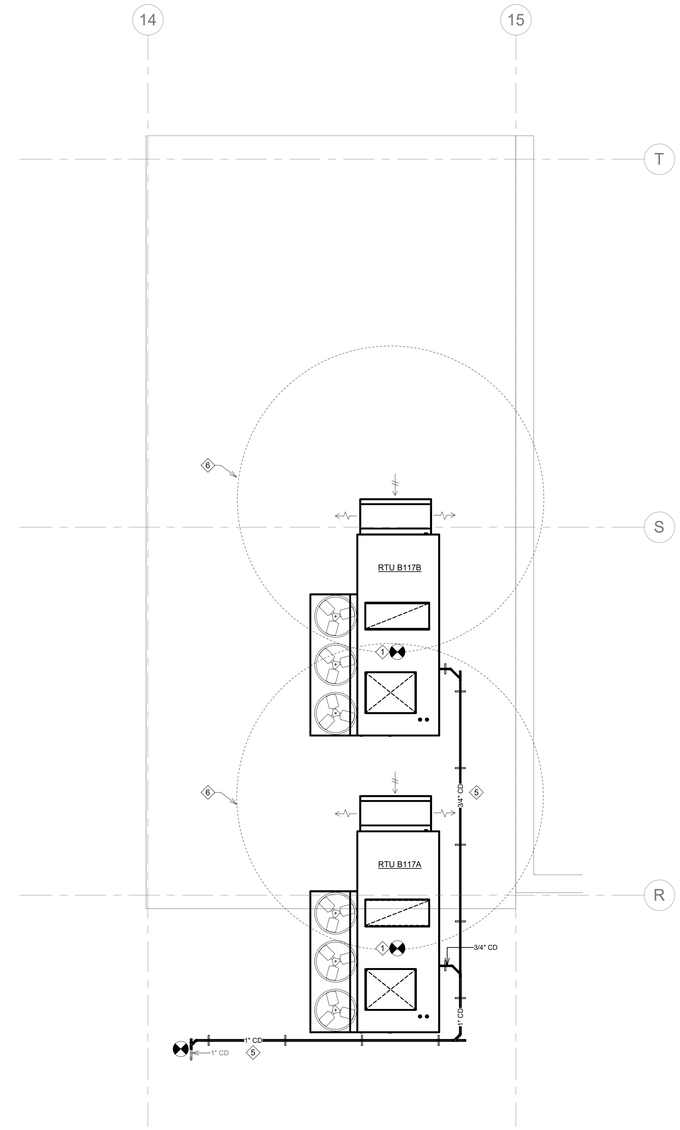
MECHANICAL NOC ROOM, ROOF AND GENERATOR DEMOLITION PLANS

M00-00

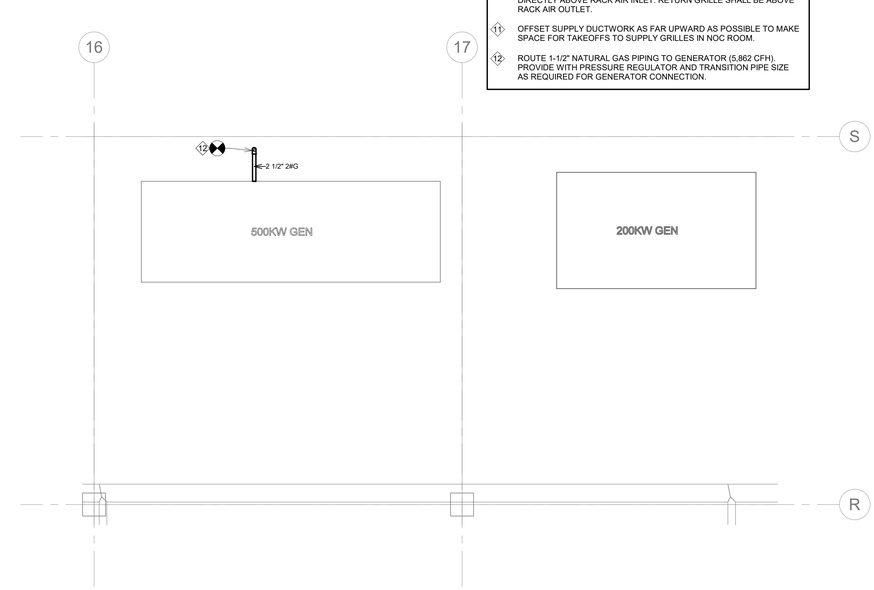
2/26/2026 9:02:12 AM M00-00 MECHANICAL NOC ROOM, ROOF AND GENERATOR DEMOLITION PLANS



1 MECHANICAL NOC ROOM PLAN
1/4" = 1'-0"



2 MECHANICAL ROOF PLAN
1/4" = 1'-0"



3 MECHANICAL GENERATOR PLAN
1/4" = 1'-0"

GENERAL NOTES:

A. FIELD VERIFY ALL EXISTING CONDITIONS AND CONNECTION POINTS PRIOR TO BIDDING AND DETERMINE ACTUAL CONDITIONS. DISCREPANCIES BETWEEN EXISTING CONDITIONS AND MECHANICAL DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID SUBMITTAL.

B. MECHANICAL CONTRACTOR SHALL REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION. ANY CONFLICTS BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR INTERPRETATION.

C. NOTHING SHALL INTERFERE WITH THE DATA CENTER OPERATIONS DURING CONSTRUCTION. IT MUST REMAIN FULLY OPERATIONAL AT ALL TIMES.

D. CONTRACTOR SHALL PROVIDE TEMPORARY COOLING TO SERVER EQUIPMENT DURING CONSTRUCTION. SERVER EQUIPMENT SHALL BE MAINTAINED AT 68°F WITH A RELATIVE HUMIDITY BETWEEN 40% AND 60% AT ALL TIMES DURING CONSTRUCTION. CONTRACTOR SHALL QUANTIFY METHOD AND APPROACH FOR TEMPORARY COOLING AS PART OF THEIR BID.

E. CUTTING AND PATCHING WORK DONE INSIDE THE NOC ROOM SHALL BE DONE IN A MANNER TO CONTAIN ALL DUST AND DEBRIS CREATED BY THE WORK SO IT DOES NOT COME IN CONTACT WITH ANY ELECTRICAL DEVICES OR 'IT' EQUIPMENT.

F. CONTRACTOR SHALL MONITOR THE PARTICULATE SIZE AND LEVEL WITHIN THE NOC ROOM DURING CONSTRUCTION, MINIMUM 3 LOCATIONS NEAR CRITICAL 'IT' EQUIPMENT. THE LEVELS SHALL BE TAKEN IN INCREMENTS OF 3 HOURS EVERY DAY, RECORDED AND DISCUSSED WITH OWNER'S 'IT' REPRESENTATIVE. IF THE LEVEL INCREASES TO A PREDETERMINED HIGH LEVEL, WORK MUST CEASE UNTIL COUNTS RETURN TO AN ACCEPTABLE LEVEL. PROVIDE PROTECTION FOR 'IT' EQUIPMENT FROM EXCESSIVE PARTICULATE LEVELS AND PHYSICAL DAMAGE.

G. CONDENSATE PIPING SHALL BE PVC SCHEDULE 80 WITH SOLVENT WELDED JOINTS.

H. PROVIDE CEILING LABEL AT EACH DIFFUSER IN CEILING IDENTIFYING SUPPLY DIFFUSER OR RETURN GRILLE.

KEY NOTES:

1. INSTALL ROOFTOP UNIT ON ADAPTER CURB. CONNECT TO EXISTING DUCT CONNECTIONS THROUGH ROOF.
2. OPEN RETURN DUCT OVER NOC ROOM PLENUM.
3. INSTALL MOTORIZED DAMPER IN DUCT MAIN CONNECTION TO ROOTOP UNIT.
4. PROVIDE TERMINATION FOR REMOTE DAMPER OPERATOR CABLE ON WALL. BOWDEN 4-PORT BALANCING STATION OR SIMILAR. PROVIDE LABELS AT BALANCING STATION AND AT CEILING FOR EACH CORRESPONDING DAMPER.
5. PROVIDE ROOF SUPPORTS FOR PIPING EVERY 5'-0" O.C. AND AT EVERY CHANGE OF DIRECTION.
6. MAINTAIN MINIMUM 10'-0" SEPARATION BETWEEN OUTSIDE AIR INTAKES, PLUMBING VENTS AND ANY EXHAUST DISCHARGES.
7. BALANCE EXISTING DIFFUSER TO AIRFLOW RATE INDICATED.
8. PROVIDE 2'X2' ACCESS PANEL IN HARD CEILING FOR FUTURE MAINTENANCE.
9. INSTALL SUPPLY DUCT STATIC PRESSURE TRANSDUCERS NEAR THIS LOCATION.
10. COORDINATE FINAL SUPPLY/RETURN GRILLE LOCATIONS WITH AIR INLETS/OUTLETS OF SERVER RACKS. SUPPLY GRILLE SHALL BE DIRECTLY ABOVE RACK AIR INLET. RETURN GRILLE SHALL BE ABOVE RACK AIR OUTLET.
11. OFFSET SUPPLY DUCTWORK AS FAR UPWARD AS POSSIBLE TO MAKE SPACE FOR TAKEOFFS TO SUPPLY GRILLES IN NOC ROOM.
12. ROUTE 1-1/2" NATURAL GAS PIPING TO GENERATOR (5,862 CFH). PROVIDE WITH PRESSURE REGULATOR AND TRANSITION PIPE SIZE AS REQUIRED FOR GENERATOR CONNECTION.

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

CORGAN

DUNHAM

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ISSUANCES	
02/26/26	ISSUE FOR CONSTRUCTION

Date of issue:
02/26/26

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ROCKWALL NOC HVAC REFIT

901 W YELLOW JACKET LN
ROCKWALL, TX 75087

JOB 1326013-000-00
DATE 02/26/26

MECHANICAL NOC ROOM, ROOF AND GENERATOR PLANS

M04-00

2/26/2026 9:02:14 AM M04-00 MECHANICAL NOC ROOM, ROOF AND GENERATOR PLANS

ROOFTOP UNIT - PACKAGED UNIT SCHEDULE

MECHANICAL

EQUIPMENT TAG	APPLICATION	SUPPLY FAN			RELIEF FAN			MIN OA (CFM)	COOLING COIL					CONDENSING UNIT				HEATING COIL				REFRIGERANT TYPE	PRE-FILTER MERV RATING	PRE-FILTER SIZE (IN)	FINAL FILTER MERV RATING	FINAL FILTER SIZE (IN)	IEER COOLING	WEIGHT (LBS)	MANUFACTURER	MODEL NUMBER	MECHANICAL NOTES
										EAT		LAT																			
		CFM	ESP (IN W.C.)	MOTOR CONTROL	CFM	ESP (IN W.C.)	MOTOR CONTROL		TYPE	DB (F)	WB (F)	DB (F)	WB (F)	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	AMBIENT TEMP (F)	NUMBER OF COMPRESSORS	NUMBER OF STAGES	NUMBER OF FANS	HOT GAS REHEAT (YES/NO)	TYPE	EAT DB (F)	LAT DB (F)	INPUT KW	OUTPUT MBH							
RTU B117A	NOC ROOM	10000	2.5	VFD	9300	0.25	VFD	700	DX	69.3	57.7	51.7	49.1	272.9	237.1	105	2	MOD.	2	NO	ELECTRIC	20.0	51.6	100	341.2	R-454B	8	2	14	12	13.2	2969	AAON	RNA-030-C-A	1,2,3,4
RTU B117B	NOC ROOM	10000	2.5	VFD	9300	0.25	VFD	700	DX	69.3	57.7	51.7	49.1	272.9	237.1	105	2	MOD.	2	NO	ELECTRIC	20.0	51.6	100	341.2	R-454B	8	2	14	12	13.2	2969	AAON	RNA-030-C-A	1,2,3,4

MECHANICAL NOTES:
1. PROVIDE 14" INSULATED ADAPTER CURB.
2. PROVIDE CONDENSATE OVERFLOW SWITCH.
3. PROVIDE WITH ECONOMIZER.
4. AAON AND TRANE ARE ONLY ACCEPTABLE MANUFACTURERS. NO EXCEPTIONS.

ELECTRICAL

EQUIPMENT TAG	HP/LOAD	VOLTAGE	PHASE	AIC RATING	CONTROLLER				DISCONNECT AT MOTOR					PANEL	CIRCUIT NUMBER	CONDUIT/FEEDER SIZE	ELECTRICAL NOTES
					TYPE	FURNISHED BY/ INSTALLED BY	LOCATION	CTRL WIRE BY	AMPS/TYPE	FUSE SIZE (AMPS)	NEMA TYPE	FURNISHED BY/ INSTALLED BY	LOCATION				
RTU B117A	143 FLA	480 V	3	10 kAIC	CP	MFGR / MFGR	NOC ROOFTOP	DIV 23	200A / DS	175A	3R	DIV 26 / DIV 26	NOC ROOFTOP	EHNOC	25,27,29	1-1/2"C, 3#2/0 + #6 G	
RTU B117B	143 FLA	480 V	3	10 kAIC	CP	MFGR / MFGR	NOC ROOFTOP	DIV 23	200A / DS	175A	3R	DIV 26 / DIV 26	NOC ROOFTOP	EHNOC	26,28,30	1-1/2"C, 3#2/0 + #6 G	

GENERAL ELECTRICAL NOTES:

A. WHEN THE CONTROLLER TYPE IS A VFD OR MAGNETIC STARTER, REFER TO THE VARIABLE FREQUENCY DRIVE CONTROLLER SCHEDULE OR THE MAGNETIC STARTER SCHEDULE FOR MORE INFORMATION.
B. CALCULATED A.I.C. VALUES LESS THAN 5,000A ARE NOT LISTED.

ELECTRICAL NOTES:

1. SINGLE POINT ELECTRICAL CONNECTION BY DIV 26.
2. INTEGRAL GFCI CONVENIENCE RECEPTACLE.

CONTROLLER TYPES:

VFD - VARIABLE FREQUENCY MOTOR CONTROLLER
MMS - MANUAL MOTOR STARTER (WITH OVERLOADS)
CP - CONTROL PANEL
MAGS - MAGNETIC STARTER
MRS/MS - MOTOR RATED SWITCH (WITHOUT OVERLOADS)

GRILLES, REGISTERS, AND DIFFUSERS SCHEDULE

MECHANICAL

EQUIPMENT TAG	APPLICATION	MOUNTING TYPE	DESCRIPTION	MATERIAL	ACCESSORIES	FINISH	MANUFACTURER	MODEL NUMBER	MECHANICAL NOTES
A	SUPPLY	GYP CEILING	PERFORATED SUPPLY GRILLE	STEEL	--	WHITE	TITUS	PAS	2,3
B	RETURN	GYP CEILING	PERFORATED RETURN GRILLE	STEEL	--	WHITE	TITUS	PAR	1
C	SUPPLY	LAY-IN CEILING	2'X2" CEILING DIFFUSER	STEEL	--	WHITE	TITUS	TMS	--
D	RETURN	WALL	RETURN GRILLE	STEEL	--	WHITE	TITUS	350RL	--
E	RETURN	LAY-IN CEILING	EGGCRATE RETURN GRILLE	STEEL	--	WHITE	TITUS	50F	--

MECHANICAL NOTES:

1. PLENUM RETURN GRILLE. NO NECK.
2. INSULATION BLANKET.
3. NO DISCHARGE PATTERN CONTROLLER.

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

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ROCKWALL NOC HVAC REFIT

901 W YELLOW JACKET LN
ROCKWALL, TX 75087

JOB 1326013-000-00
DATE 02/26/26

MECHANICAL AND ELECTRICAL SCHEDULES

M06-00

RTU B117A & B117B SEQUENCE OF OPERATION

A. THE SYSTEM CONSISTS OF TWO (2) SINGLE ZONE, VARIABLE VOLUME DX ROOFTOP UNITS (RTU B117A AND RTU B117B) WITH VARIABLE FREQUENCY DRIVES (VFD'S) CONTROLLING THE SUPPLY AND POWERED EXHAUST FANS. ALSO INCLUDED ARE RETURN, AND OUTSIDE AIR DAMPERS.

B. THE UNITS SHALL HAVE A MICROPROCESSOR BASED CONTROLLER WHICH SHALL MONITOR AND CONTROL THE UNIT IN A STAND-ALONE MODE OR AS DIRECTED BY THE BUILDING AUTOMATION SYSTEM.

C. ONE (1) RTU WILL OPERATE CONTINUOUSLY 24/7. THE RTU RUN TIMES SHALL BE MONITORED AND THE UNITS SHALL BE ROTATED ON A WEEKLY BASIS (ADJ.) TO MAINTAIN EQUAL RUNTIMES.

D. IF COMMUNICATIONS IS LOST WITH THE BAS, THE CONTROLLER WILL OPERATE USING DEFAULT MODES OR SETPOINTS.

E. IF ONE RTU IS COMMANDED TO DE-ENERGIZE, THE, THE ALTERNATE UNITS SHALL BE COMMANDED TO ENERGIVE.

F. CONTROLS SEQUENCES, POINTS, AND GRAPHICS SHALL BE FULLY INTEGRATED INTO THE ALERTON OR NIAGRA BAS. ALL CONTROLS COMPONENTS PROVIDED SHALL BE NON-PROPRIETARY.

G. ALARM NOTIFICATION SHALL BE SENT TO THE FACILITY ENGINEERS VIA EMAIL AND TEST IN ADDITION TO ALARMING AT THE BMS FRONT END.

START SEQUENCE

A. ONCE THE RTU HAS BEEN DIRECTED TO START, THE OUTSIDE AIR DAMPER (D-OA) SHALL OPEN TO ITS PRE-DETERMINED POSITION AND THE ASSOCIATED SUPPLY AIR MOTORIZED DAMPER (D-SA) WILL OPEN.

B. ONCE DAMPER POSITIONS ARE PROVEN BY THE END SWITCHES (ESO-D-OA AND ESO-D-SA), THE SUPPLY FAN(S) SHALL BE ENERGIZED (REFER TO FAN CONTROL BELOW).

SUPPLY AIR TEMPERATURE RESET CONTROL

A. THE DISCHARGE AIR TEMPERATURE SETPOINT (TT-SAT) WILL BE RESET TO THE OPTIMAL SETPOINT COMMUNICATED BY THE BAS. IF THE SUPPLY AIR TEMPERATURE DROPS BELOW THE MINIMUM LIMIT (45°F; ADJ)., A LOW TEMPERATURE ALARM WILL BE ANNUNICATED AND THE UNIT WILL SHUTDOWN. IF THE DISCHARGE TEMPERATURE RISES ABOVE THE HIGH LIMIT SETPOINT, A HIGH TEMPERATURE ALARM WILL BE ANNUNICATED AND THE UNIT WILL SHUTDOWN.

OUTDOOR AIR TEMPERATURE RESET:

A. THE DISCHARGE AIR TEMPERATURE SETPOINT (TT-SAT) WILL BE ADJUSTED BASED ON THE OUTSIDE AIR TEMPERATURE (TT-OA) AND THE COOLING AND HEATING LOAD OF THE BUILDING.

FAN CONTROL

A. DURING REQUEST FOR OPERATION, THE SUPPLY FAN (SAF) WILL RUN CONTINUOUSLY. THE UNIT CONTROLLER WILL VARY THE SUPPLY FAN SPEED TO OPTIMIZE THE MINIMUM FAN SPEED IN ALL COOLING AND HEATING MODES.

B. WITH AIRFLOW PROVEN BY MANUFACTURER PROVIDED AIR PROVING SWITCH, THE SUPPLY FAN (SAF) WILL RAMP UP TO MINIMUM SPEED UNTIL THE UNIT DETERMINES A REQUEST FOR INCREASE COOLING OR HEATING EXISTS.

C. THE UNIT CONTROLLER WILL CONTROL THE SUPPLY FAN (SAF) SPEED TO MAINTAIN THE CURRENT DUCT STATIC PRESSURE SETPOINT (ADJ).

D. SPACE TEMPERATURE WILL BE MAINTAINED WITHIN IN 1.0°F OF THE ACTIVE COOLING SETPOINT (68°F) AND HEATING SETPOINT (68°F).

E. IF THE SUPPLY DUCT STATIC PRESSURE REACHES 2.0 INCHES W.C. (ADJ.), THE HIGH LIMIT PRESSURE SWITCH (SPT-HI) WILL SHUTDOWN THE UNIT AND ISSUE AN ALARM, REQUIRING A MANUAL RESET TO RE-START THE UNIT.

F. THE POWERED EXHAUST FAN (EAF) SHALL ACTIVATE AND MODULATE IN RESPONSE TO SPACE PRESSURE (+0.05).

G. WHEN THE SUPPLY FAN (SAF) SHUTS DOWN, THE OUTSIDE AIR DAMPER (D-OA) AND SUPPLY AIR DAMPER (D-SA) SHALL CLOSE.

DUCT STATIC PRESSURE CONTROL:

A. DUCT STATIC PRESSURE SETPOINT (SPT-SAP) WILL BE RESET TO THE OPTIMAL SETPOINT COMMUNICATED BY THE BAS. IF THE SUPPLY DUCT STATIC PRESSURE (SPT-SAP) FALLS BELOW 0.5 INCHES OF W.C. (ADJ.) THE UNIT CONTROLLER WILL INCREASE THE OUTPUT OF THE VFD TO MAINTAN SETPOINT.

HEATING/COOLING MODE

A. THE UNIT CONTROLLER WILL USE THE SPACE TEMPERATURE SENSOR AND SPACE TEMPERATURE SETPOINT TO DETERMINE WHEN TO INITATE REQUESTS FOR COOLING.

B. THE DX COOLING COIL AND ELECTRIC HEATING COIL WILL BE STAGED AS NECESSARY TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

HEATING MODE

A. THE UNIT CONTROLLER WILL USE SPACE TEMPERATURE AND SPACE TEMPERATURE SETPOINT TO DETERMINE WHEN TO INITATE REQUESTS FOR HEAT.

B. WHEN THE SPACE TEMPERATURE DROPS BELOW A TEMPERATURE SETPOINT 65°F (ADJ.), THE UNIT CONTROLLER WILL MODULATE THE ELECTRIC HEATING COIL (E-HTG) TO MAINTAIN THE SPACE TEMPERATURE SETPOINT. ONCE THE SPACE TEMPERATURE RISES ABOVE THE ROOM TEMPERATURE SETPOINT, THE ELECTRIC HEATING COIL WILL BE DISABLED.

COOLING MODE

A. THE NOC SPACE SHALL BE MAINTAINED AT 68°F (ADJ.) AND A RELATIVE HUMIDITY BETWEEN 30% AND 60%.

B. THE UNIT CONTROLLER WILL USE SPACE TEMPERATURE SENSOR (TT-RM), TEMPERATURE COOLING SETPOINT, AND SPACE RELATIVE HUMIDITY (HT-RM) TO CALCULATE THE DISCHARGE AIR TEMPERATURE SETPOINT AND DETERMINE WHEN TO INITATE REQUESTS FOR COOLING.

C. THE FIRST COMPRESSOR WILL ENERGIZE AND MODULATE TO MEET COOLING DEMAND. IF ADDITIONAL COOLING CAPACITY IS REQUIRED, THE SECOND COMPRESSOR WILL BE ENABLED AND MODULATE TO MEET THE COOLING DEMAND. ONCE THE ACTIVE COOLING DEMAND HAS BEEN SATISIFIED, COMPRESSORS WILL BEGIN STAGING IN REVERSE ORDER FROM THE STAGE UP SEQUENCE.

ECONOMIZER CYCLE

A. THE ECONOMIZER CYCLE WILL BE AUTOMATICALLY USED BY THE BAS WHEN OUTDOOR CONDITIONS ARE ACCEPTABLE. THIS WILL BE DETERMINED BY COMPARING THE ENTHALPY OF THE OUTSIDE AIR AND THE ENTHALPY OF THE RETURN AIR. WHEN THE ENTHALPY OF THE OUTSIDE AIR IS LESS THAN THE ENTHALPY OF THE RETURN AIR, ECONOMIZER MODE SHALL BE INITIATED.

B. WHEN ECONOMIZING IS ENABLED AND THE UNIT IS OPERATING IN COOLING MODE, THE ECONOMIZER DAMPER WILL BE MODULATED BETWEEN ITS MINIMUM POSITION AND 100% TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT. THE ECONOMIZER DAMPER WILL MODULATE TOWARD ITS MINIMUM POSITION IN THE EVENT THE DISCHARGE AIR TEMPERATURE FALLS BELOW THE DISCHARGE LOW LIMIT TEMPERATURE SETPOINT. THE ECONOMIZER SHALL BE DISABLED WHEN OUTDOOR AIR ENTHALPY IS GREATER THAN THE RETURN AIR ENTHALPY.

C. WHEN ECONOMIZER IS ENABLED, FREE COOLING WILL BE THE FIRST STAGE OF COOLING AND COMPRESSORS WILL BE STAGED AS NECESSARY.

D. THE ECONOMIZER WILL CONTINUE MODULATING OR RETURN TO ITS MINIMUM POSITION AS DETERMINED BY COOLING AND MINIMUM AIRFLOW REQUIREMENTS.

FILTERS

A. THE FILTERS SHALL HAVE A DIFFERENTIAL PRESSURE SWITCH (DPS-PFL) AND (DPS-FFL) MEASURING THE PRESSURE DROP ACROSS THE PRE- AND FINAL FILTER BANKS. IT SHALL ALARM THE DDC SYSTEM WHENEVER THE PRESSURE DROP ACROSS THE FILTER IS EXCESSIVE (DIRTY FILTER). (ADJ.).

FIRE ALARM SHUTDOWN

A. WHENEVER THE SUPPLY OR RETURN FIRE DUCT SMOKE DETECTORS (SD-SA OR SD-RA) SENSE SMOKE, THE FIRE ALARM SYSTEM SHALL SHUTDOWN THE FAN(S) VIA THE FIRE ALARM RELAY AND SIGNAL THE DDC SYSTEM. THE DDC SYSTEM SHALL DE-ENERGIZE THE UNIT AND CLOSE THE OUTSIDE AIR DAMPER (D-OA) AND THE RETURN AIR DAMPER (D-RET) SHALL BE OPENED.

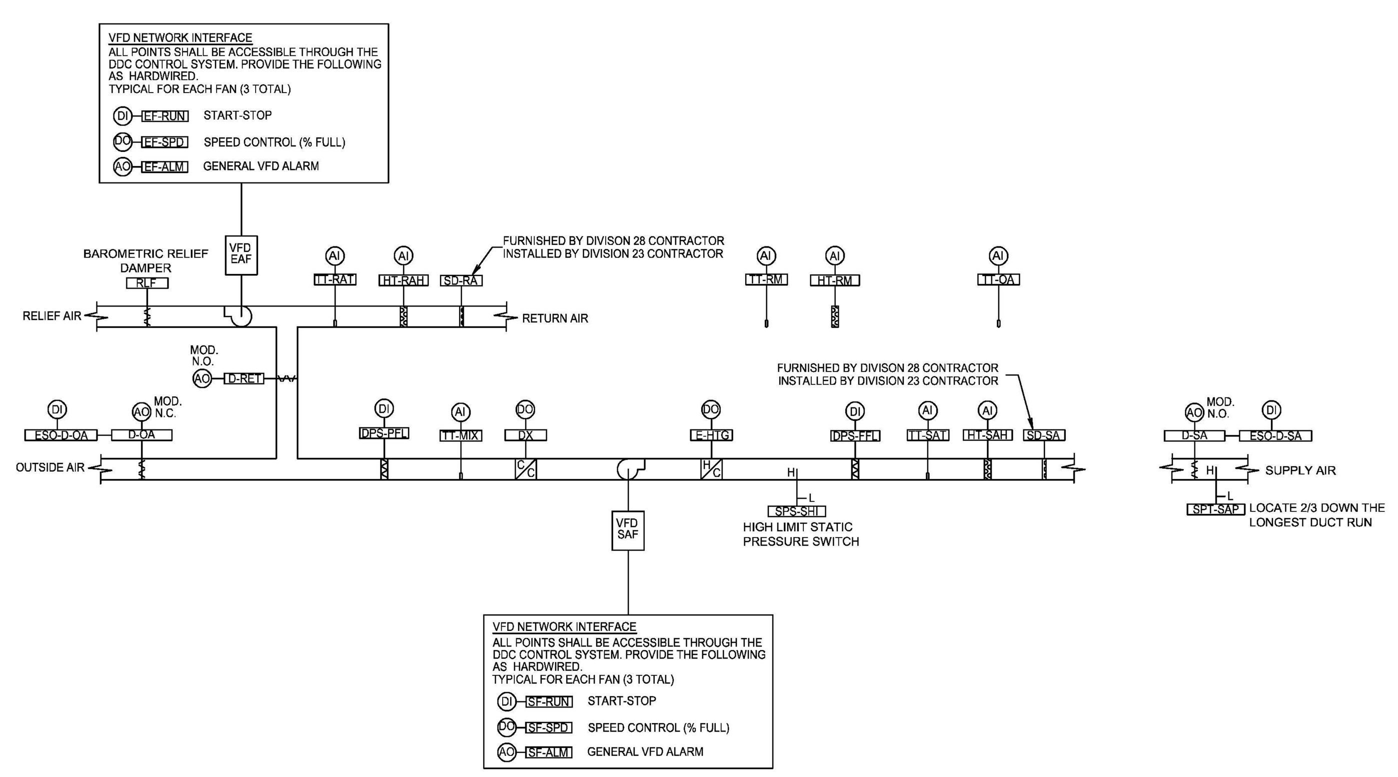
CONDENSATE OVERFLOW MONITORING

A. IF THE CONDENSATE LEVEL (OVRFL) REACHES THE TRIP POINT, A CONDENSATE DISGNOSTIC WILL BE ANNUNICATED TO THE BAS TO PREVENT THE CONDENSATE DRAIN FROM OVERFLOWING AND CAUSING WATER DAMAGE TO THE BUILDING AND THE SUPPLY FAN AND DX COOLING COIL WILL BE DISABLED.

NOC SPACE

A. ROOM TEMPERATURE SENSOR (TT-RM) SHALL MONITOR SPACE TEMPERATURE AND ISSUE AND ALARM IF SPACE TEMPERATURE DROPS BELOW 62°F (ADJ) OR ABOVE 75°F (ADJ).

B. ROOM HUMIDITY SENSOR (HT-RM) SHALL MONITOR SPACE RELATIVE HUMIDITY AND ISSUE AND ALARM IF SPACE RELATIVE HUMIDITY DROPS BELOW 30% (ADJ) OR ABOVE 60% (ADJ).



RTU B117A & B117B CONTROL DIAGRAM

NO SCALE

CONTROLS SYMBOLS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
AM-SA	SUPPLY FAN AIRFLOW	S/S	START / STOP
AM-OA	OUTSIDE AIRFLOW	SD-RA	RETUN AIR SMOKE DETECTOR
AI	ANALOG INPUT	SD-SA	SUPPLY AIR SMOKE DETECTOR
AO	ANALOG OUTPUT	SF-ALM	SUPPLY FAN VFD ALARM
CO2	CO2 SENSOR	SPT-SA	SUPPLY DUCT STATIC
CSR	CURRENT SENSING RELAY	SPS-SHI	SUPPLY FAN HIGH STATIC
D-OA	OA DAMPER O/C	SF-SPD	SUPPLY FAN VFD SPEED
DAT	DISCHARGE AIR TEMPERATURE	SPS-RLO	RETURN FAN LOW STATIC
DI	BINARY INPUT	SF-RUN	SUPPLY FAN VFD S/S
DO	BINARY OUTPUT	TT-FZ	FREEZESTAT
DP-CHW	DIFFERENTIAL PRESSURE SENSOR	TT-MIX	MIXED AIR TEMPERATURE
DPS-FIL	PRE-FILTER DP	TT-SAT	SUPPLY TEMPERATURE
DPS-FFL	FINAL FILTER DP	TT-RAT	RETURN TEMPERATURE
D-RAS	RETURN AIR SMOKE DAMPER	V-CW	CW VALVE COMMAND
D-RET	RETURN AIR DAMPER O/C	V-HUM	HUMIDIFIER VALVE COMMAND
EH-SA	SUPPLY AIR ELECTRIC HEATER	V-HW	HW VALVE COMMAND
ESO	END SWITCH OPERATOR	VFD-SAF	SUPPLY FAN VFD
ESO-D-OA	OA DAMPER ESO	VFD-RAF	RETURN FAN VFD
ESO-D-RAS	RETURN AIR SMOKE DAMPER ESO		
FLTG	FLOATING POINT		
HT-RAH	RETURN HUMIDITY		
HT-SAH	SUPPLY HUMIDITY		
RF-RUN	RETURN FAN VFD S/S		
RF-SPD	RETURN FAN VFD SPEED		
RF-ALM	RETURN FAN VFD GENERAL ALARM		

RTU B117A & B117B DDC INPUT/OUTPUT POINTS LIST

OUTPUT (DIGITAL / ANALOG)

POINT DESCRIPTION (1)	DESIGNATION	QUANTITY PER RTU	GRAPHIC DISPLAY	DAMPER OPEN/CLOSE	START/STOP	FORCE ON	FORCE OFF	ENABLE/DISABLE	DAMPER CONTROL (ANALOG)	VALVE CONTROL (ANALOG)	CONTROL (MODULATING) (ANALOG)	FIXED PRESET (ANALOG)
CONTROL PANEL												
SENSORS												
SUPPLY TEMPERATURE	TT-SAT	1	X									
RETURN TEMPERATURE	TT-RAT	1	X									
MIXED AIR TEMPERATURE	TT-MIX	1	X									
OUTSIDE AIR TEMPERATURE	TT-OA	1	X									
RETURN AIR HUMIDITY	HT-RAH	1	X									
SUPPLY AIR HUMIDITY	HT-SAH	1	X									
NOC ROOM RELATIVE HUMIDITY	HT-RM	1	X									
NOC ROOM TEMPERATURE	TT-RM	1	X									
SUPPLY DUCT STATIC	SPT-SAP	1	X									
SUPPLY FAN HIGH STATIC	SPT-SHI	1	X									
SUPPLY AIR SMOKE DETECTOR	SD-SA	1	X									
RETURN AIR SMOKE DETECTOR	SD-RA	1	X									
PRE-FILTER DIFFERENTIAL	DPS-PFL	1	X									
FINAL FILTER DIFFERENTIAL	DPS-FFL	1	X									
DAMPERS												
RETURN AIR DAMPER O/C	D-RET	1	X						X			
OA DAMPER O/C	D-OA	1	X	X					X			
OA DAMPER ESO	ESO-D-OA	1	X						X			X
SUPPLY AIR DAMPER O/C	D-SA	1	X	X					X			
SUPPLY AIR DAMPER ESO	ESO-D-SA	1	X						X			
SUPPLY FAN VFD	VFD-SAF	1									X	
SUPPLY FAN VFD S/S	SF-RUN	1	X		X							
SUPPLY FAN VFD SPEED	SF-SPD	1	X									
SUPPLY FAN VFD GENERAL ALARM	SF-ALM	1										
EXHAUST FAN VFD	VFD-EAF	1									X	
EXHAUST FAN VFD S/S	EF-RUN	1	X		X							
EXHAUST FAN VFD SPEED	EF-SPD	1	X									
EXHAUST FAN VFD GENERAL ALARM	EF-ALM	1										
ELECTRIC COIL	E-HTG	1	X		X					X		
CONDENSATE OVERFLOW SWITCH	OVRFL	1	X		X							

INPUT (DIGITAL / ANALOG)

POINT DESCRIPTION (1)	DESIGNATION	CURRENT RELAY (CSR)	END SWITCH (ESO)	DIFFERENTIAL PRESSURE (DPS)	RELAY CONTACT	PRESSURE SWITCH (PS)	FLOW SWITCH (FS)	HAND SWITCH	AUX CONTACTS	STATUS	ALARM	TEMPERATURE (DB)	RELATIVE HUMIDITY (HT)	DIFFERENTIAL PRESSURE (DPT)	PRESSURE (PT)	FLOW (FM, AFMS)	KW	DEW POINT	HERTZ REFERENCE	SPEED/POS FEEDBACK	PULSE	MEASURE
CONTROL PANEL																						
SENSORS																						
SUPPLY TEMPERATURE	TT-SAT											X										
RETURN TEMPERATURE	TT-RAT											X										
MIXED AIR TEMPERATURE	TT-MIX											X										
OUTSIDE AIR TEMPERATURE	TT-OA											X										
RETURN AIR HUMIDITY	HT-RAH												X									
SUPPLY AIR HUMIDITY	HT-SAH												X									
NOC ROOM RELATIVE HUMIDITY	HT-RM												X									
NOC ROOM TEMPERATURE	TT-RM											X										
SUPPLY DUCT STATIC	SPT-SAP					X																
SUPPLY FAN HIGH STATIC	SPT-SHI					X																
SUPPLY AIR SMOKE DETECTOR	SD-SA			X																		
RETURN AIR SMOKE DETECTOR	SD-RA			X																		
PRE-FILTER DIFFERENTIAL	DPS-PFL			X																		
FINAL FILTER DIFFERENTIAL	DPS-FFL			X																		
DAMPERS																						
RETURN AIR DAMPER O/C	D-RET																					
OA DAMPER O/C	D-OA																					
OA DAMPER ESO	ESO-D-OA																					
SUPPLY AIR DAMPER O/C	D-SA																					
SUPPLY AIR DAMPER ESO	ESO-D-SA																					
SUPPLY FAN VFD	VFD-SAF										X											
SUPPLY FAN VFD S/S	SF-RUN																					
SUPPLY FAN VFD SPEED	SF-SPD																				X	
SUPPLY FAN VFD GENERAL ALARM	SF-ALM																					
EXHAUST FAN VFD	VFD-EAF										X											
EXHAUST FAN VFD S/S	EF-RUN																					
EXHAUST FAN VFD SPEED	EF-SPD																				X	
EXHAUST FAN VFD GENERAL ALARM	EF-ALM																					
ELECTRIC COIL	E-HTG																					
CONDENSATE OVERFLOW SWITCH	OVRFL																					

SOFTWARE (ALARMS / CALCULATED VALVES / PROGRAMS)

POINT DESCRIPTION (1)	DESIGNATION	COMMUNICATION FAILURE	STATUS FAILURE	HIGH LIMIT	LOW LIMIT	SMOKE	DIAGNOSTICS	MAINTENANCE	KW	BTUH	CFM	GPM	RUN TIME HOURS	SCHEDULED START/STOP	ALARM (2)	EMERGENCY STOP	NIGHT SETBACK	MORNING WARMUP	DAYTIME WARMUP	OCCUPIED/UNOCCUPIED	AUTO RESTART	DEMAND LIMITING	EVENT PROGRAMS	RUN TIME TOTALIZATION	FAIL MODE (CLOSED)	FAIL MODE (OPEN)	TREND LOGGING	DISCHARGE	TEMP RESET	SUPPLY AIR RESET	SOFTWARE CONTROL POINT	NETWORK INTERFACE POINT	REMARKS - SEE NOTE NO.
CONTROL PANEL		X					X						X	X	X	X	X	X	X		X											
SENSORS																																
SUPPLY TEMPERATURE	TT-SAT			X	X										X												X						
RETURN TEMPERATURE	TT-RAT			X	X																						X						
MIXED AIR TEMPERATURE	TT-MIX				X																						X						
OUTSIDE AIR TEMPERATURE	TT-OA				X																						X						
RETURN AIR HUMIDITY	HT-RAH			X	X										X												X						
SUPPLY AIR HUMIDITY	HT-SAH			X	X										X												X						
NOC ROOM RELATIVE HUMIDITY	HT-RM			X	X										X												X						
NOC ROOM TEMPERATURE	TT-RM			X	X										X												X						
SUPPLY DUCT STATIC	SPT-SAP		X	X	X										X												X						
SUPPLY FAN HIGH STATIC	SPT-SHI		X												X															X			
SUPPLY AIR SMOKE DETECTOR	SD-SA					X									X								X										
RETURN AIR SMOKE DETECTOR	SD-RA					X									X								X										
PRE-FILTER DIFFERENTIAL	DPS-PFL							X																									
FINAL FILTER DIFFERENTIAL	DPS-FFL							X																									
DAMPERS																																
RETURN AIR DAMPER O/C	D-RET		X																							X							
OA DAMPER O/C	D-OA		X																						X		X						
OA DAMPER ESO	ESO-D-OA																																
SUPPLY AIR DAMPER O/C	D-SA																																
SUPPLY AIR DAMPER ESO	ESO-D-SA		X																							X							
SUPPLY FAN VFD	VFD-SAF													X							X			X			X						
SUPPLY FAN VFD S/S	SF-RUN																																
SUPPLY FAN VFD SPEED	SF-SPD																																
SUPPLY FAN VFD GENERAL ALARM	SF-ALM		X																														
EXHAUST FAN VFD	VFD-EAF													X							X			X			X						
EXHAUST FAN VFD S/S	EF-RUN																																
EXHAUST FAN VFD SPEED	EF-SPD																																
EXHAUST FAN VFD GENERAL ALARM	EF-ALM		X																														
ELECTRIC COIL	E-HTG														X																		
CONDENSATE OVERFLOW SWITCH	OVRFL		X												X																		

NOTES:
1. THE FOLLOWING MINIMUM CONTROL POINTS SHALL BE PROVIDED WITH THE RTU MANUFACTURER CONTROLLER OR BY CONTROLS CONTRACTOR.
2. ALARM NOTIFICATION SHALL BE SENT TO THE FACILITY ENGINEERS VIA EMAIL AND TEST IN ADDITION TO ALARMING AT THE BMS FRONT END.

GENERATOR DDC INPUT/OUTPUT POINTS LIST

POINT DESCRIPTION (1)	DESIGNATION	QUANTITY PER RTU	GRAPHIC DISPLAY	AUX CONTACTS (INPUT DIGITAL)	ALARM (2) (SOFTWARE PROGRAMS)
EMERGENCY GENERATOR STATUS		1	X	X	X
EMERGENCY GENERATOR ALARM		1	X	X	X
EMERGENCY GENERATOR LOW FUEL		1	X	X	X
EMERGENCY GENERATOR UNDER VOLTAGE		1	X	X	X
EMERGENCY GENERATOR TRANSFER SWITCH		1	X	X	X

(All other columns of the generator points list — same column headings as the RTU list — are empty.)

NOTES:
1. THE FOLLOWING MINIMUM CONTROL POINTS SHALL BE PROVIDED WITH THE RTU MANUFACTURER CONTROLLER OR BY CONTROLS CONTRACTOR.
2. ALARM NOTIFICATION SHALL BE SENT TO THE FACILITY ENGINEERS VIA EMAIL AND TEST IN ADDITION TO ALARMING AT THE BMS FRONT END.

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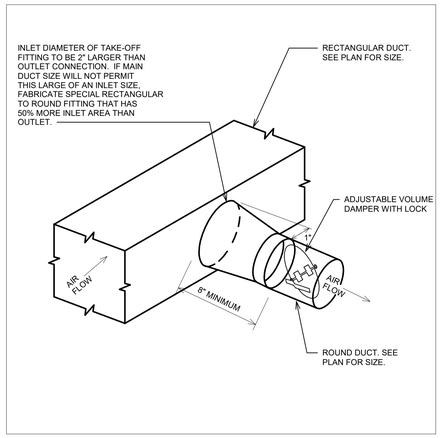
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ROCKWALL, TX 75087

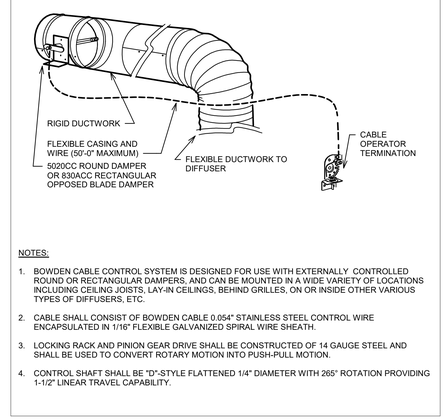
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MECHANICAL CONTROLS DIAGRAMS

M07-00



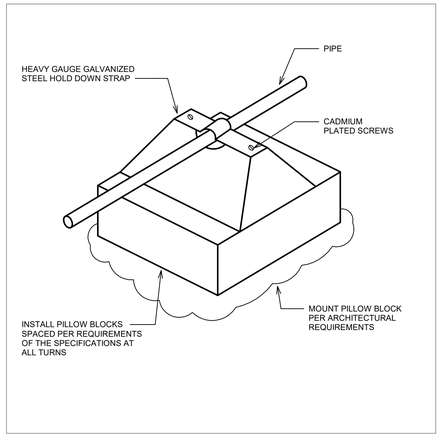
1 DUCT TAKE-OFF TO DIFFUSER DETAIL
NO SCALE



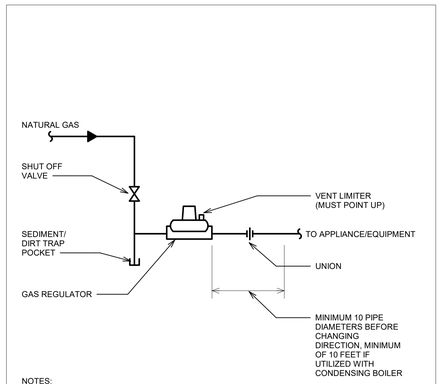
NOTES:

1. BOWDEN CABLE CONTROL SYSTEM IS DESIGNED FOR USE WITH EXTERNALLY CONTROLLED ROUND OR RECTANGULAR DAMPERS, AND CAN BE MOUNTED IN A WIDE VARIETY OF LOCATIONS INCLUDING CEILING JOISTS, LAY-IN CEILINGS, BEHIND GRILLES, ON OR INSIDE OTHER VARIOUS TYPES OF DIFFUSERS, ETC.
2. CABLE SHALL CONSIST OF BOWDEN CABLE 0.054" STAINLESS STEEL CONTROL WIRE ENCAPSULATED IN 1/16" FLEXIBLE GALVANIZED SPIRAL WIRE SHEATH.
3. LOCKING RACK AND PINION GEAR DRIVE SHALL BE CONSTRUCTED OF 14 GAUGE STEEL AND SHALL BE USED TO CONVERT ROTARY MOTION INTO PUSH-PULL MOTION.
4. CONTROL SHAFT SHALL BE "D"-STYLE FLATTENED 1/4" DIAMETER WITH 265° ROTATION PROVIDING 1-1/2" LINEAR TRAVEL CAPABILITY.

2 LINEAR DIFFUSER CABLE DAMPER CONTROL DETAIL
NO SCALE



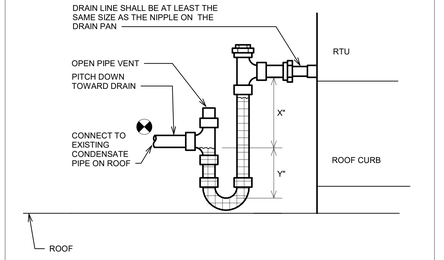
3 PIPE ROOF SUPPORT DETAIL WITH PILLOW BLOCKS
NO SCALE



NOTES:

1. FOR INDOOR OR OUTDOOR APPLICATIONS.
2. WHEN USED OUTDOORS, VENT LIMITER REQUIRES CORROSION RESISTANT ANODIZED COATING.

5 OPEN TO AIR VENT GAS REGULATOR DETAIL
NO SCALE



CONDENSATE TRAP SIZING FOR DRAW THROUGH ROOFTOP UNIT.
X = NEGATIVE STATIC PRESSURE AT THE DRAIN PAN + 2"
Y = X, IF SPACE ALLOWS BUT NOT LESS THAN 1/2 X.

NEGATIVE PRESSURE AT THE DRAIN IS EQUAL TO THE MAXIMUM STATIC PRESSURE ON THE DRAIN PAN INCLUDING MAXIMUM FILTER PRESSURE DROP AND PRESSURE DROP OF FUTURE COMPONENTS OF UNIT OR SYSTEM IF APPLICABLE.

NOTES:

1. PITCH DRAIN PAN AT 1/4" PER FOOT MINIMUM SLOPE TO DRAIN.
2. PROVIDE SHOP DRAWING FOR DRAIN PAN AND CONDENSATE PIPING FOR REVIEW WITH ROOFTOP UNIT SUBMITTAL.
3. DRAIN LINE SHALL BE AT LEAST THE SAME SIZE AS THE NIPPLE ON THE DRAIN PAN.

4 DRAW THROUGH AHU CONDENSATE TRAP DETAIL
NO SCALE

2/26/2026 9:02:20 AM M08-00 MECHANICAL DETAILS

Deadline: March 31, 2026 - 2:30 PM

CORGAN

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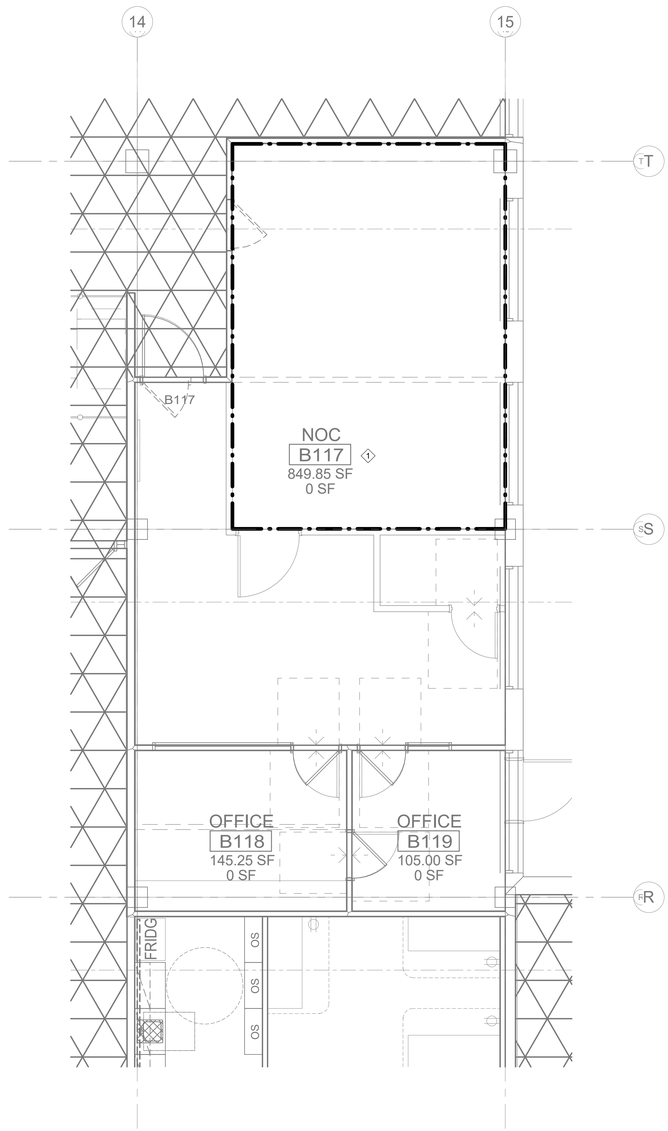
M08-00

GENERAL NOTES:

A. FIRE PROTECTION CONTRACTOR SHALL REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION. ANY CONFLICTS BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR INTERPRETATION.

KEY NOTES:

1. MODIFY EXISTING SYSTEM AND PROVIDE NEW HEADS AND/OR PIPING FOR PRE-ACTION AND CLEAN AGENT SYSTEMS IN DASHED AREA TO BE COMPLIANT WITH NFPA 13, NFPA 2001 AND ALL APPLICABLE LOCAL CODES FOR NEW CEILING LAYOUT IN NOC ROOM. AREA ABOVE CEILING WILL BE USED AS A RETURN AIR PLENUM.



1 FIRE PROTECTION NOC ROOM PLAN
1/4" = 1'-0"

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

CORGAN

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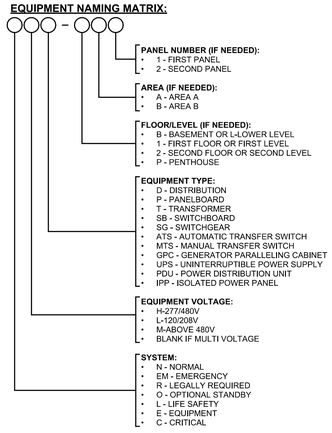
FIRE PROTECTION NOC ROOM PLAN AND DETAILS

F04-01

ELECTRICAL ABBREVIATIONS

A, AMP	AMPERES	M	METER
ABV	ABOVE	MC	MOMENTARY CONTACT OR MECHANICAL CONTRACTOR
AG	ABOVE GRADE		
AA	AUDIBLE ALARM	MCB	MAIN CIRCUIT BREAKER
AC	ABOVE COUNTER	MCC	MOTOR CONTROL CENTER
ACH	ABOVE COUNTER HEIGHT	MH	MAN HOLE
ADD	ADDENDUM	MLO	MAIN LUG ONLY
AFC	AVAILABLE FAULT CURRENT	MMFO	MULTI MODE FIBER OPTIC
AFCI	ARC FAULT CIRCUIT INTERRUPTER	MR	MOTOR RATED SWITCH
AFF	ABOVE FINISHED FLOOR	MSB	MAIN SWITCHBOARD
AHU	AIR HANDLING UNIT	MT	EMPTY
AL	ALUMINUM	MTR	MOTOR
ANT	ANTENNA	N	NEUTRAL
ATS	AUTOMATIC TRANSFER SWITCH	NC	NORMALLY CLOSED
AV	AUDIO VISUAL	NEC	NATIONAL ELECTRICAL CODE
AWG	AMERICAN WIRE GUAGE	NIC	NOT IN CONTRACT
BAS	BUILDING AUTOMATION SYSTEM	NO	NORMALLY OPEN
BFC	BELOW FINISHED CEILING	NTS	NOT TO SCALE
BPS	BOLTED PRESSURE SWITCH	OC	ON CENTER
C	CONDUIT OR CONTROLLED RECEPT	PB	PULL BOX OR PUSHBUTTON
CAB	CABINET	PE	PNEUMATIC ELECTRIC
CB	CIRCUIT BREAKER	PF	POWER FACTOR
CCTV	CLOSED CIRCUIT TV	PH	PHASE
CKT	CIRCUIT	PNL	PANEL
CLG	CEILING	PRI	PRIMARY
COMM	COMMUNICATIONS	PT	POTENTIAL TRANSFORMER
CT	CURRENT TRANSFORMER	R	RACEWAY
CTRL	CONTROL	RECEPT	RECEPTACLE
CU	COPPER	REFG	REFRIGERATOR
DAS	DISTRIBUTED ANTENNA SYSTEM	RTU	ROOF TOP UNIT
DED	DEDICATED	SEC	SECONDARY
DN	DOWN	SGB	SERVICE GROUND BAR
EC	ELECTRICAL CONTRACTOR	SMFO	SINGLE MODE FIBER OPTIC
EGB	ELECTRICAL GROUND BAR	SPKR	SPEAKER
ELEC	ELECTRIC OR ELECTRICAL	STP	SHIELDED TWISTED PAIR
EM	EMERGENCY	SUB	SUBSTATION
EMT	ELECTRICAL METALLIC TUBING	SW	SWITCH
ENCL	ENCLOSURE	SWBD	SWITCHBOARD
EP	ELECTRIC PNEUMATIC	TEL	TELEPHONE
EPO	EMERGENCY POWER OFF	TELCOM	TELECOMMUNICATIONS
EWC	ELECTRIC WATER COOLER	TGB	TELECOMMUNICATIONS GROUND BAR
F	FUSE OR FUSED	TMGB	TELECOMMUNICATIONS MAIN GROUND BAR
FA	FIRE ALARM	TR	TAMPER RESISTANT
FAAP	FIRE ALARM ANNUNCIATOR PANEL	TSTAT	THERMOSTAT
FACP	FIRE ALARM CONTROL PANEL	TYP	TYPICAL
FB	FLOOR BOX	UC	UNDER COUNTER
FO	FIBER OPTIC	UF	UNDER FLOOR
FSD	FIRE-SMOKE DAMPER	UG	UNDER GROUND
FV	FILM VIEWER	UH	UNIT HEATER
G, GND	GROUND	UNO	UNLESS NOTED OTHERWISE
GC	GENERAL CONTRACTOR	USB	UNIVERSAL SERIAL BUS
GFEP	GROUND FAULT EQUIPMENT PROTECTION	UTP	UNSHIELDED TWISTED PAIR
GFI, GFCI	GROUND FAULT CIRCUIT INTERRUPTER	V	VOLT OR VOLTAGE
HH	HAND HOLE	VA	VOLT-AMP
HOA	HAND OFF AUTO	VAC	VOLTS ALTERNATING CURRENT
IG	ISOLATED GROUND	VDC	VOLTS DIRECT CURRENT
JBOX	JUNCTION BOX	W	WATT, WIRE OR WALL PHONE
KV	KILOVOLT	WAP	WIRELESS ACCESS POINT
KVA	KILOVOLT-AMP	WP	WEATHERPROOF
KW	KILOWATT	X	EXISTING
KWH	KILOWATT-HOUR	XFMR	TRANSFORMER

EQUIPMENT NAMING MATRIX:



EXAMPLES:
NHD-B1A1 = NORMAL POWER, 277/480V, DISTRIBUTION BOARD LOCATED ON THE FIRST FLOOR, AND IS THE FIRST PANEL IN AREA A.
LLP-BB1 = LIFE SAFETY POWER, 120/208V, PANEL BOARD LOCATED ON THE BASEMENT FLOOR, AND IS THE FIRST PANEL IN AREA B
CT-P1 = CRITICAL POWER, TRANSFORMER LOCATED ON THE PENTHOUSE LEVEL AND IS THE FIRST TRANSFORMER.

ELECTRICAL SYMBOLS LEGEND

SYMBOL SCHEDULE NOTES

A. THESE SYMBOLS COMPRISE A STANDARD LIST, NOT ALL SYMBOLS MAY APPEAR ON THESE DRAWINGS.

B. MOUNTING HEIGHTS INDICATED ARE STANDARD. DIMENSIONAL NUMBERS INDICATED AT DEVICES SHALL OVERRIDE THESE STANDARDS. MOUNTED HEIGHTS ARE TO THE CENTER OF THE DEVICE, UNLESS NOTED OTHERWISE.

C. MOUNTING HEIGHTS INDICATED ARE FOR STUD WALL CONSTRUCTION. WHEN BLOCK OR BRICK CONSTRUCTION IS USED, ADJUST MOUNTING HEIGHTS TO ALIGN DEVICE PLATES WITH RUNNING JOINT.

D. REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.

GENERAL

SYMBOL	DESIGNATIONS
	LIGHT SOLID LINE WEIGHT INDICATES EXISTING ITEM TO REMAIN.
	DARK DASHED LINE WEIGHT INDICATES EXISTING ITEM TO BE REMOVED.
	DARK SOLID LINE WEIGHT INDICATES NEW ITEM OR NEW LOCATION.
R	REMOVE EXISTING ITEM
RL	REMOVE EXISTING ITEM AND RELOCATE AS INDICATED
X	EXISTING ITEM TO REMAIN
NL	NEW LOCATION FOR RELOCATED ITEM

NOTES & TAGS

SYMBOL	DESIGNATIONS
XX / ##	EQUIPMENT IDENTIFICATION TAG - SEE EQUIPMENT SCHEDULES
XXX-X	FEEDER SIZE TAG - SEE POWER RISER SCHEDULE
#C	ELEC EQUIP CONNECTION TAG - SEE EQUIP SCHEDULE
#	KEYNOTE
#	MISCELLANEOUS NOTE
LC / #	LIGHTING CONTROL SEQUENCE - SEE SCHEDULE
X" W X" H X' - X" AFF	CABLE TRAY TAG X" W - WIDTH OF CABLE TRAY X" H - HEIGHT OF CABLE TRAY X' - X" AFF - MOUNTING HEIGHT OF CABLE TRAY (FROM FINISH FLOOR TO BOTTOM OF TRAY)

RACEWAYS

SYMBOL	DESIGNATIONS
	CONDUIT CONCEALED IN CEILING OR WALLS
	CONDUIT CONCEALED IN THE FLOOR OR BELOW
	CONDUIT EXPOSED ON THE CEILING OR WALLS
UG - #	CONDUIT BURIED UNDERGROUND (# = DEPTH)
	CONDUIT WITH BEND DOWN
	CONDUIT WITH BEND UP
	CONDUIT WITH BUSHED END
	CONDUIT WITH BREAK OR CONTINUATION
L1 1,3,5	CIRCUIT HOME RUN - L1 INDICATES PANEL - NUMBER
# #	JUNCTION BOX - WALL/CEILING MOUNT
	WIREWAY, DUCT BANK, OR FLOOR DUCT AS NOTED
	CABLE TRAY, TYPE/SIZE AS INDICATED

LIGHTING

SYMBOL	DESIGNATIONS	
b A #	LIGHT FIXTURE ID - REFER TO LIGHT FIXTURE SCHEDULE (SCHEDULE OVERRIDES SYMBOL ABBREVIATION) A - INDICATES LIGHT FIXTURE TYPE # - INDICATES CIRCUIT NUMBER b - INDICATES SWITCHING	
	LIGHT FIXTURE CIRCUIT TYPE - NO HATCH INDICATES NORMAL CIRCUIT - ANGLED HATCH INDICATES CRITICAL CIRCUIT - SOLID HATCH INDICATES LIFE SAFETY CIRCUIT	
	TROFFER TYPE LIGHT FIXTURE, SIZE AS INDICATED - CEILING MOUNT	
	CHANNEL OR INDUSTRIAL, LENGTH AS INDICATED	
	CHANNEL OR INDUSTRIAL WALL MOUNT, LENGTH AS INDICATED	
	ROUND DOWNLIGHT, RECESSED OR SURFACE MOUNT	
	SQUARE DOWNLIGHT, RECESSED OR SURFACE MOUNT	
	CEILING WALL WASH FIXTURE OR TRACK HEAD	
	WALL MOUNT FIXTURE OR SCONCE	VERIFY
	LINEAR SUSPENDED , LENGTH AS INDICATED	VERIFY
	LINEAR RECESSED, LENGTH AS INDICATED	VERIFY
	ROUND OR SQUARE PENDANT	
	TAPE OR ROPE LIGHT	
	UNDER CABINET FIXTURE, LENGTH AS INDICATED	
	TRACK FIXTURE, NUMBER OF HEADS AS INDICATED	
	VANITY FIXTURE	
	EMERGENCY BATTERY LIGHT - WALL/CEILING MOUNT	
	EXIT LIGHT, FILLED QUADRANT INDICATES FACES - WALL/CEILING MOUNT	VERIFY
	WALL PACK	VERIFY
	FLAG OR FLOOD LIGHT	
	SITE LIGHTING POLE FIXTURE, ROUND/RECTANGLE HEAD - NUMBER OF HEADS INDICATED	
	SITE LIGHTING ROUND OR SQUARE BOLLARD	
	CEILING FAN	

SWITCHES AND CONTROLS

SYMBOL	DESIGNATIONS	MTG HT
$	SINGLE POLE TOGGLE SWITCH	48"
$2	DOUBLE POLE TOGGLE SWITCH	48"
$3	THREE WAY TOGGLE SWITCH	48"
$4	FOUR WAY TOGGLE SWITCH	48"
$a	TOGGLE SWITCH - "a" INDICATES SWITCHING	48"
$	PILOT LIGHT TOGGLE SWITCH	48"
$IL	ILLUMINATED TOGGLE - TOGGLE SWITCH	48"
$K	KEYED SWITCH	48"
$MC	MOMENTARY CONTACT TOGGLE SWITCH	48"
$TS	TIMER SWITCH	48"
$$$	MULTI SWITCH, MULTI GANG BOX	48"
PB	PUSH BUTTON SWITCH	48"
C	CONTACTOR	60"
CL A	CURRENT LIMITER	VERIFY
D	DIMMER SWITCH	48"
OS	OCCUPANCY SENSOR - CLG MOUNT	
VS	VACANCY SENSOR - CLG MOUNT	
$OS	OCCUPANCY SENSOR WALL SWITCH	48"
OS	OCCUPANCY SENSOR WALL DIMMER	48"
VS	VACANCY SENSOR WALL DIMMER	48"
PC	PHOTO ELECTRIC CELL	VERIFY
TC	TIME CLOCK	60"
R	RELAY	VERIFY
•••	PUSH BUTTON STATION - BUTTONS AS INDICATED	48"

POWER

SYMBOL	DESIGNATIONS	MTG HT
	BRANCH CIRCUIT PANEL	VERIFY
	EQUIPMENT CABINET	VERIFY
ATS=AUTOMATIC TRANSFER SWITCH	UPS=UNITERUPTABLE POWER SUPPLY	
TS=TRANSFER SWITCH	T=TRANSFORMER	
	MOTOR OR MOTOR CONNECTION	VERIFY
	MOTOR CONTROLLER, STARTER OR VFD	VERIFY
	COMBINATION STARTER & DISCONNECT SWITCH	VERIFY
	FUSED DISCONNECT SWITCH	VERIFY
	DISCONNECT SWITCH	VERIFY
$MR	MOTOR RATED TOGGLE	VERIFY
$MMS	MANUAL MOTOR STARTER SWITCH WITH THERMAL OVERLOAD	VERIFY
	DUPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	EMERGENCY DUPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	SPLIT DUPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	EMERGENCY SPLIT DUPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	SIMPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	EMERGENCY SIMPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	QUADPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	EMERGENCY QUADPLEX RECEPTACLE - WALL/CEILING MOUNT	18"
	GFI RECEPTACLE, DUPLEX/QUADPLEX - WALL MOUNT	18"
	GFI RECEPTACLE, DUPLEX/QUADPLEX - CEILING MOUNT	
C	GFI RECEPTACLE, DUPLEX/QUADPLEX - CONTROLLED - CEILING MOUNT	
C	DUPLEX RECEPTACLE - CONTROLLED - WALL/CEILING MOUNT	18"
	GFI DEAD FRONT DEVICE, NORMAL/EMERGENCY - WALL MOUNT	18"
	SPECIAL PURPOSE RECEPTACLE - WALL/CEILING MOUNT	18"
	EMERGENCY SPECIAL PURPOSE RECEPTACLE - WALL/CEILING MOUNT	18"
	POKE-THRU - DEVICES AS INDICATED	
	FLOOR BOX - DEVICES AS INDICATED	
P	POWER POLE - DEVICES AS INDICATED	VERIFY
G	GROUND REFERENCE BUS - AS NOTED - WALL/CEILING MOUNT	VERIFY

SIGNAL AND COMMUNICATIONS

SYMBOL	DESIGNATIONS	MTG HT
# #	DATA OUTLET - WALL/CEILING MOUNT (# = WIRE COUNTS)	18"
# # #	VOICE/DATA OUTLET - WALL/CEILING MOUNT FLOOR OUTLET (# = WIRE COUNTS)	18"
W	WALL PHONE - HIGH WALL MOUNT	48"
	WIRELESS ACCESS POINT - WALL/CEILING MOUNT	VERIFY
S	SPEAKER - WALL/CEILING MOUNT	96"
	HORN SPEAKER - WALL MOUNT	96"
	VOLUME SWITCH - WALL MOUNT	60"
	AUDIO JACK (M=MICROPHONE, A=AUXILIARY)	18"
M	WALL INTERCOM STATION (M=MASTER, R=REMOTE)	48"
	BUZZER - WALL/CEILING MOUNT	96"
	BELL - WALL/CEILING MOUNT	96"
	CHIME - WALL/CEILING MOUNT	96"
#	CLOCK - WALL/CEILING MOUNT (# = DIAMETER)	96"
VID	PROJECTOR/VIDEO CAMERA/DOCUMENT CAMERA - WALL/CEILING MOUNT	VERIFY
	TV SYSTEM OUTLET - WALL/CEILING MOUNT	18"
	AUDIO VIDEO SYSTEM OUTLET - WALL/CEILING MOUNT	18"
	A/V SYSTEMS CONTROLLER - WALL MOUNT	18"
	A/V MONITOR - WALL MOUNT	18"
ANN	ANNUNCIATOR PANEL - WALL MOUNT TYPICAL	VERIFY
	TWO-POST RACK	FLOOR
	FOUR-POST RACK	FLOOR
	DATA CABINET	FLOOR

FIRE ALARM

SYMBOL	DESIGNATIONS			MTG HT
F	FIRE ALARM - WALL MOUNTED - TYPICAL			NOTED
F	FIRE ALARM - CEILING MOUNTED - TYPICAL			
AS	AIR SAMPLING	#	HEAT DETECTOR (FIXED TEMP [°F])	
B-R	BEAM DETECTOR (RECEIVER)	R	HEAT DETECTOR (RATE OF RISE [°F] PER MINUTE)	
B-T	BEAM DETECTOR (TRANSMITTER)	MP	MANUAL PULL STATION (48")	
CP	CEILING PROTECTION	MM	MONITOR MODULE	
SA	COMBINATION SMOKE DETECTOR AND ALARM	RI	REMOTE INDICATOR LAMP (72")	
		RS	REMOTE STATION (72")	
CM	CONTROL MODULE	I	SMOKE DETECTOR (IONIZATION)	
DH	DOOR HOLD			
SD	SMOKE DUCT/DAMPER CONNECTION	P	SMOKE DETECTOR (PHOTO ELEC)	
SD	SMOKE DAMPER CONNECTION	CO	CARBON MONOXIDE	
FP	FLOOR PROTECTION	TS	TAMPER SWITCH	
FS	FLOW SWITCH			
	DUCT MOUNTED PHOTOELECTRIC DETECTOR			
SD	COMBINATION DUCT MOUNTED PHOTOELECTRIC DETECTOR/SMOKE DAMPER CONNECTION			
FS	FIREMAN'S STATION - WALL MOUNT			48"
	FIRE ALARM PANEL - WALL MOUNT			VERIFY
AMP	AMPLIFIER	FAAP	FIRE ALARM ANNUNCIATOR PANEL	
VESDA	ASPIRATING SMOKE DETECTION	FACP	FIRE ALARM CONTROL PANEL	
		NAC	NOTIFICATION APPLIANCE CIRCUIT	

FIRE ALARM/MASS NOTIFICATION

SYMBOL	DESIGNATIONS	MTG HT
W F W A A A	F=FIRE ALARM / A=ALERT R [RED] = HAZARD, W [WHITE] = FIRE ALARM, B [BLUE] = SECURITY, A [AMBER] = ALERT NOTIFICATION STROBE LIGHT IS WHITE UNLESS NOTED OTHERWISE	
F #	STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
C F	BELL - WALL/CEILING MOUNT	82"
C F	BELL/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
C F	CHIME - WALL/CEILING MOUNT	82"
C F	CHIME/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
M F	HORN - WALL/CEILING MOUNT	82"
M F	HORN/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
S F	SPEAKER - WALL/CEILING MOUNT	82"
S F	SPEAKER/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
FAAP FAAP	FIRE ALARM/ALERT NOTIFICATION: SPEAKER/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
FAAP FAAP	FIRE ALARM/ALERT NOTIFICATION: HORN/STROBE - WALL/CEILING MOUNT (# = CANDELA)	82"
M A M A	MASS NOTIFICATION CONSOLE - WALL/DESK MOUNT	VERIFY

SECURITY

SYMBOL	DESIGNATIONS			MTG HT
S	SECURITY - WALL MOUNT - TYPICAL			48"
S	SECURITY - CEILING MOUNT - TYPICAL			CLG
CH	DOOR CHIME	ML	MAGNETIC LOCK	
CR	CARD READER	MI	MASTER INTERCOM & DIRECTORY UNIT	
CR/KP	CARD READER W/ KEY PAD			
DA	DOOR ALARM	M	MASTER STATION	
DB	DOOR BELL	MW	MICROWAVE	
DZ	DOOR BUZZER	MS	MONITOR STRIKE	
DC	DOOR CONTACT	MD	MOTION DETECTOR	
DS	DURESS SYSTEM	ODC	OVERHEAD DOOR CONTACT	
DO	ELECTRIC DOOR OPENER	P	PANIC BAR	
EL	ELECTRIC LOCK	TH	POWER TRANSFER HINGE	
ES	ELECTRIC STRIKE	PB	PUSH BUTTON	
EP	EXIT PUSHBUTTON	RX	REQUEST TO EXIT	
GB	GLASS BREAKER DETECTOR	S	SECURITY ANTENNA	
IR	INFRA-RED DETECTOR	UD	ULTRASONIC DETECTOR	
IC	INTERCOM UNIT			
KP	KEYPAD			
KS	KEY SWITCH			
	SECURITY PANEL - WALL MOUNT - TYPICAL			VERIFY
SEC - SECURITY		CA - CARD ACCESS		
IDS - INTRUSION DETECTION SYSTEM				
IM	SECURITY CAMERA - WALL/CEILING MOUNT			VERIFY
IM	SECURITY DOME CAMERA - WALL/CEILING MOUNT			VERIFY

NURSE CALL

SYMBOL	DESIGNATIONS			MTG HT
N	NURSE CALL - WALL MOUNT - TYPICAL			VERIFY
AI	AUXILIARY INPUT STATION	M	MASTER STATION	
ANN	ANNUNCIATOR PANEL	BD	PATIENT BED STATION	
CC	CALL CANCEL	P	PATIENT STATION (ENHANCED)	
C-B	CODE BABY STATION	P1	PATIENT STATION (BASIC)	
C-B/SA	CODE BABY/STAFF ASSIST COMBINATION STATION	TV	PATIENT TV STATION	
		M1	SECONDARY MASTER STATION	
C	CODE BLUE STATION	SA	STAFF ASSIST STATION	
C/SA	CODE BLUE/STAFF ASSIST COMBINATION STATION	WF	WORK FLOW (TOUCH SCREEN)	
		WF1	WORK FLOW (4-BUTTON)	
D	DUTY STATION			
E	EMERGENCY PULL STATION			
N	LOCATOR ANTENNA			
N Z N	DOME LIGHT - WALL/CEILING MOUNT (BLANK = 4 LIGHTS [STANDARD], Z = ZONE INDICATOR LIGHTS)			96"
NCP	NURSE CALL PANEL - WALL MOUNT			VERIFY

ONE LINE AND RISER

SYMBOL	DESIGNATIONS
ID V, Ø, W	UTILITY SERVICE: EQUIPMENT ID VOLTAGE, PHASE, 3 OR 4 WIRE
ID KW/KVA V, Ø, W PF	ENGINE GENERATOR: EQUIPMENT ID KW/KVA RATING OF GENERATOR VOLTAGE, PHASE, 3 OR 4 WIRE, POWER FACTOR
XX AF/AT	600 VOLT MOLDED CASE CIRCUIT BREAKER: AF = AMP FRAME, AT = AMP TRIP XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AF/AT	600 VOLT INSULATED CASE CIRCUIT BREAKER: AF = AMP FRAME, AT = AMP TRIP XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AF/AT	600 VOLT DRAWOUT CIRCUIT BREAKER: AF = AMP FRAME, AT = AMP TRIP XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AF/AT	15,000 VOLT DRAWOUT CIRCUIT BREAKER: AF = AMP FRAME, AT = AMP TRIP XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AS	DISCONNECT SWITCH: AS = AMP SWITCH XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AF	FUSE: AF = AMP FUSE XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
XX AS/AF	FUSED DISCONNECT SWITCH: AS = AMP SWITCH, AF = AMP FUSE XX = OPTIONS TO BE PROVIDED, MAY BE BLANK
ID KVA V	TRANSFORMER: EQUIPMENT ID KVA RATING OF TRANSFORMER PRIMARY VOLTAGE SECONDARY VOLTAGE
ID KVA V	TRANSFORMER WITH SPECIAL CORE: EQUIPMENT ID KVA RATING OF TRANSFORMER PRIMARY VOLTAGE SECONDARY VOLTAGE
ID V, Ø, W A MCB SPACES KAIC	PANELBOARD: EQUIPMENT ID VOLTAGE, PHASE, 3 OR 4 WIRE, AMP RATING MCB OR MLO SPACES AVAILABLE CALCULATED FAULT CURRENT
ID V, Ø, W A XX KAIC	TRANSFER SWITCH: EQUIPMENT ID VOLTAGE, PHASE, 3 OR 4 WIRE, AMP RATING OPEN/CLOSED/DELAYED CALCULATED FAULT CURRENT
ID HP Ø	MOTOR: EQUIPMENT ID HORSEPOWER, PHASE
M M M M M M MF	MULTIFUNCTION RELAY: NUMBERS INDICATE ANSI DEVICE NUMBERS
XX	FEEDER DESCRIPTION: SEE ELECTRICAL ONE LINE SHEET FOR SCHEDULE
	STATIC SWITCH
	MOTOR OVERLOAD PROTECTION DEVICE
ID TR:XX	POTENTIAL TRANSFORMER: TR = TURNS RATIO
ID TR:XX	CURRENT TRANSFORMER: TR = TURNS RATIO
	LIGHTNING ARRESTER
	GROUND CONNECTION
	CAPACITOR
	BATTERY
NO	CONTACTOR - NORMALLY OPEN
NC	CONTACTOR - NORMALLY CLOSED
K1	KIRK KEY INTERLOCK
M A V	METER: M = WATTHOUR METER, A = AMMETER, V = VOLT METER
	15,000 VOLT TEE AND ELBOW
	LINEWORK: EQUIPMENT ENCLOSURE LINE SWITCHGEAR BUS LINE BUSWAY NEW WORK EXISTING WORK DEMO WORK FUTURE WORK

OPTIONS ABBREVIATIONS:
LSI = LONG TIME/SHORT TIME/INSTANTANEOUS TRIP SETTINGS
LSIG = LSI WITH GROUND FAULT PROTECTION
EO=ELECTRICALLY OPERATED
M1=METER (REFER TO METER SCHEDULE)
ST=SHUNT TRIP
K1=KIRK KEYED (REFER TO KIRK KEY SCHEDULE)

ELECTRICAL SHEET LIST

SHEET NUMBER	SHEET NAME
.ELEC	SYMBOLS AND ABBREVIATIONS
E00-00	NOC ROOM DEMOLITION
E01-01	FIRST FLOOR REFERENCE POWER PLAN
E01-02	SECOND FLOOR REFERENCE POWER PLAN
E04-00	NOC ROOM POWER PLAN
E04-01	ENLARGED POWER PLANS AND DETAILS
E06-00	PANEL SCHEDULES
M06-00	MECHANICAL AND ELECTRICAL SCHEDULES

SHEET TOTAL: 8

Deadline: March 31, 2026 - 2:30 PM

ROCKWALL INDEPENDENT SCHOOL DISTRICT

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ISSUANCES

02/26/26	ISSUE FOR CONSTRUCTION

2026.02.25 14:53:07-06'00'

STATE OF TEXAS
JUSTIN A. THINER
158421
LICENSED
PROFESSIONAL ENGINEER
2/26/26

Date of issue:
02/26/26

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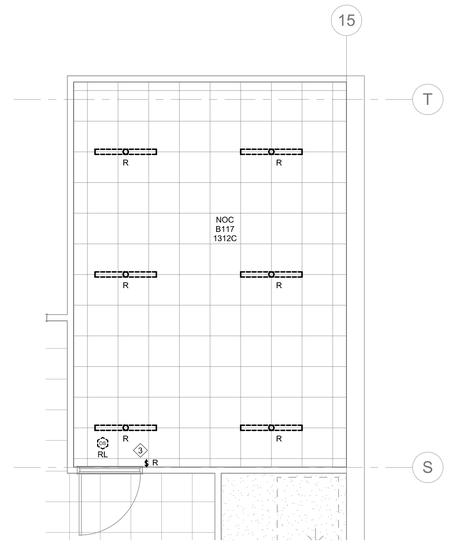
ROCKWALL NOC HVAC REFIT

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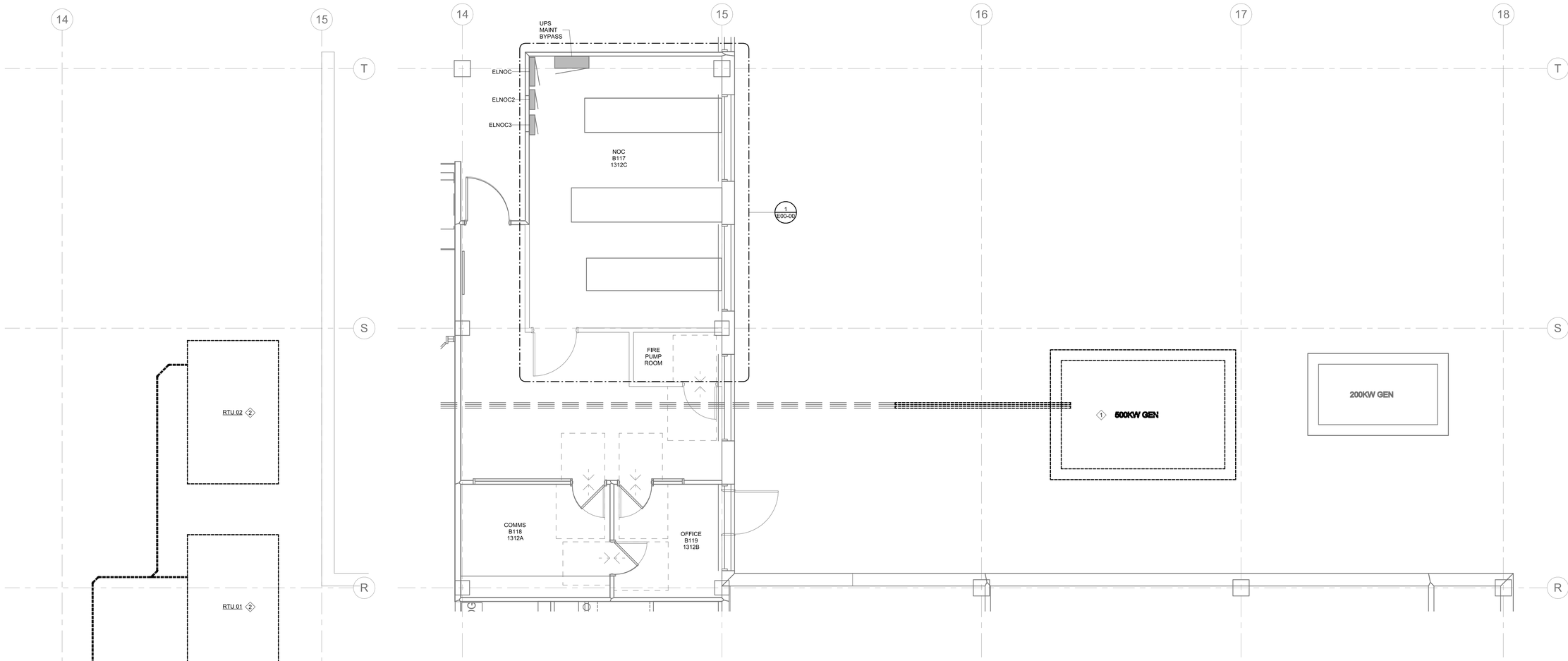
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DATE	02/26/26

SYMBOLS AND ABBREVIATIONS

.ELEC



1 NOC EXISTING REFLECTED CEILING PLAN
1/4" = 1'-0"



2 NOC EXISTING LAYOUT
1/4" = 1'-0"

3 ROOF DEMOLITION PLAN
1/4" = 1'-0"

GENERAL NOTES:

A. REFER TO ARCHITECTURAL DRAWINGS FOR CONSTRUCTION PHASING REQUIREMENTS.

B. REFER TO SHEET .ELEC FOR ELECTRICAL SYMBOL LEGEND.

C. MAINTAIN SERVICE TO LIGHT FIXTURES, WIRING DEVICES, FIRE ALARM AND SPECIAL SYSTEMS DEVICES OUTSIDE OF WORK SCOPE AREA.

KEY NOTES:

1. DEMOLISH 500KW GENERATOR AND CONCRETE PAD. PULL BACK CABLES AND PARTIALLY REMOVE CONDUITS FOR INSTALLATION OF A GENERATOR DOCKING STATION. LOCATION OF UNDERGROUND CONDUITS IS APPROXIMATE AND SHALL BE DETERMINED IN THE FIELD. FOR ADDITIONAL INFORMATION, SEE DEMOLITION DETAIL, SHEET E04-01, DETAIL #1.

2. DEMOLISH ELECTRICAL EQUIPMENT SERVICING ROOF TOP UNITS (DISCONNECT SWITCHES, MAINTENANCE RECEPTACLES, AND ROOFTOP CONDUIT) BACK TO THEIR SOURCES. IF ANY ROOF PENETRATIONS REMAIN, SEAL TO PREVENT WATER INGRESS POLYWATER AFT-16 OR APPROVED EQUAL. ROOF SEALANT MUST BE UL RECOGNIZED, AND HAVE PASSED UL94 WITH A CLASS HBF FIRE RETARDANT RATING, HOLDS 10 FEET OF CONTINOUS WATER HEAD PRESSURE. WITHSTANDS COLD TEMPERATURE APPLICATIONS.

3. HVAC DUCTS WILL BE REWORKED ABOVE THE NOC ROOM. TEMPORARILY REMOVE ELECTRICAL AND SPECIAL SYSTEMS DEVICES AND EQUIPMENT (FIRE ALARM DEVICES, WIRING DEVICES, SPEAKERS, ETC) WITHIN THE ROOM. THEN REPLACE ONCE THE DUCTWORK HAS BEEN RELOCATED. LIGHT FIXTURES TO BE REMOVED. RETAIN BRANCH CIRCUIT FOR NEW LIGHTING. FOR NEW ARRANGEMENT, SEE SHEET E04-00, DETAIL #1.

Deadline: March 31, 2026 - 2:30 PM

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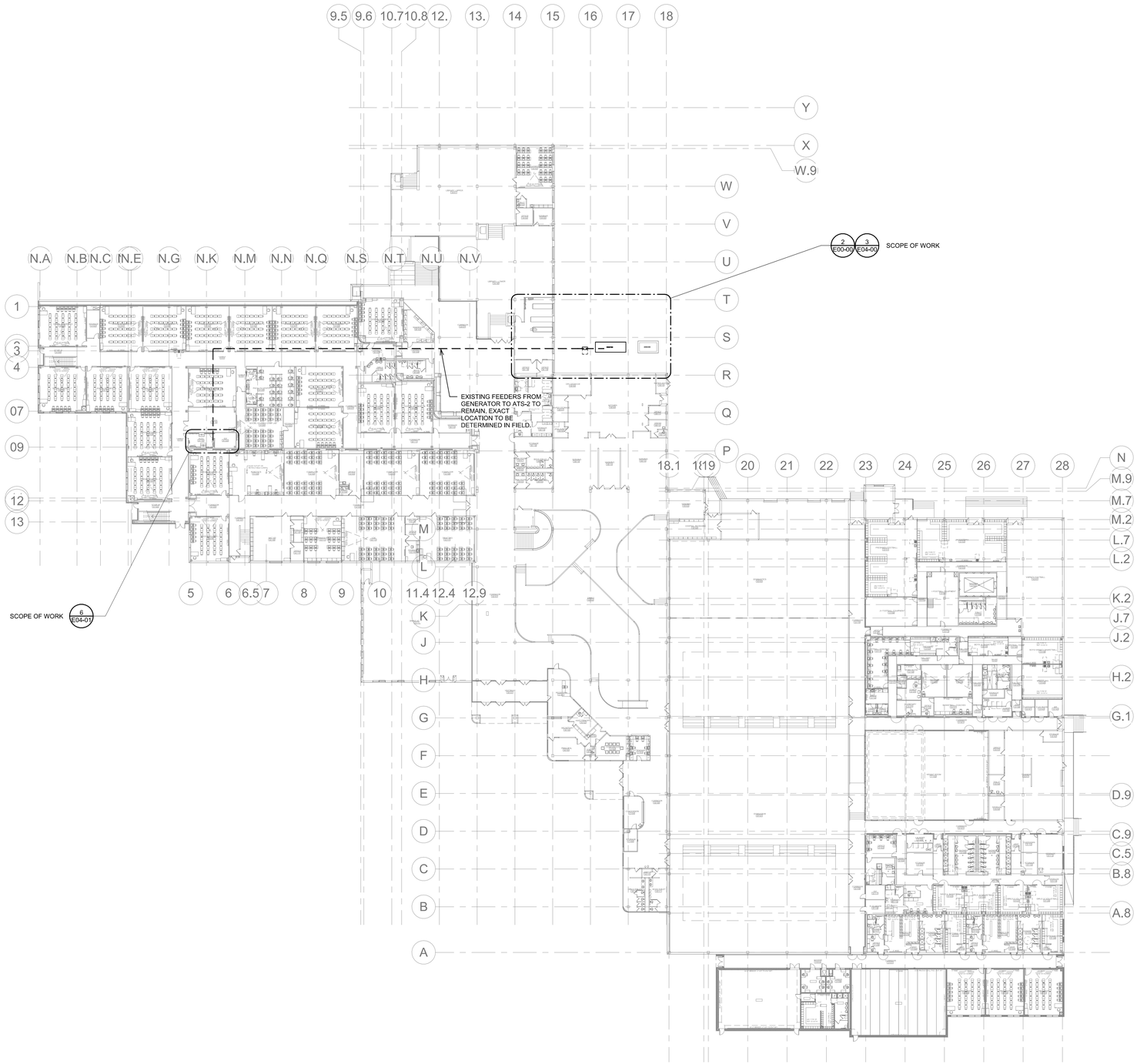
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DATE	02/26/26

NOC ROOM DEMOLITION

E00-00

2/25/2026 2:38:31 PM E00-00 NOC ROOM DEMOLITION



1 ELECTRICAL FIRST FLOOR PLAN
1" = 30'-0"

2/25/2026 2:38:32 PM E01-01 FIRST FLOOR REFERENCE POWER PLAN

Deadline: March 31, 2026 - 2:30 PM

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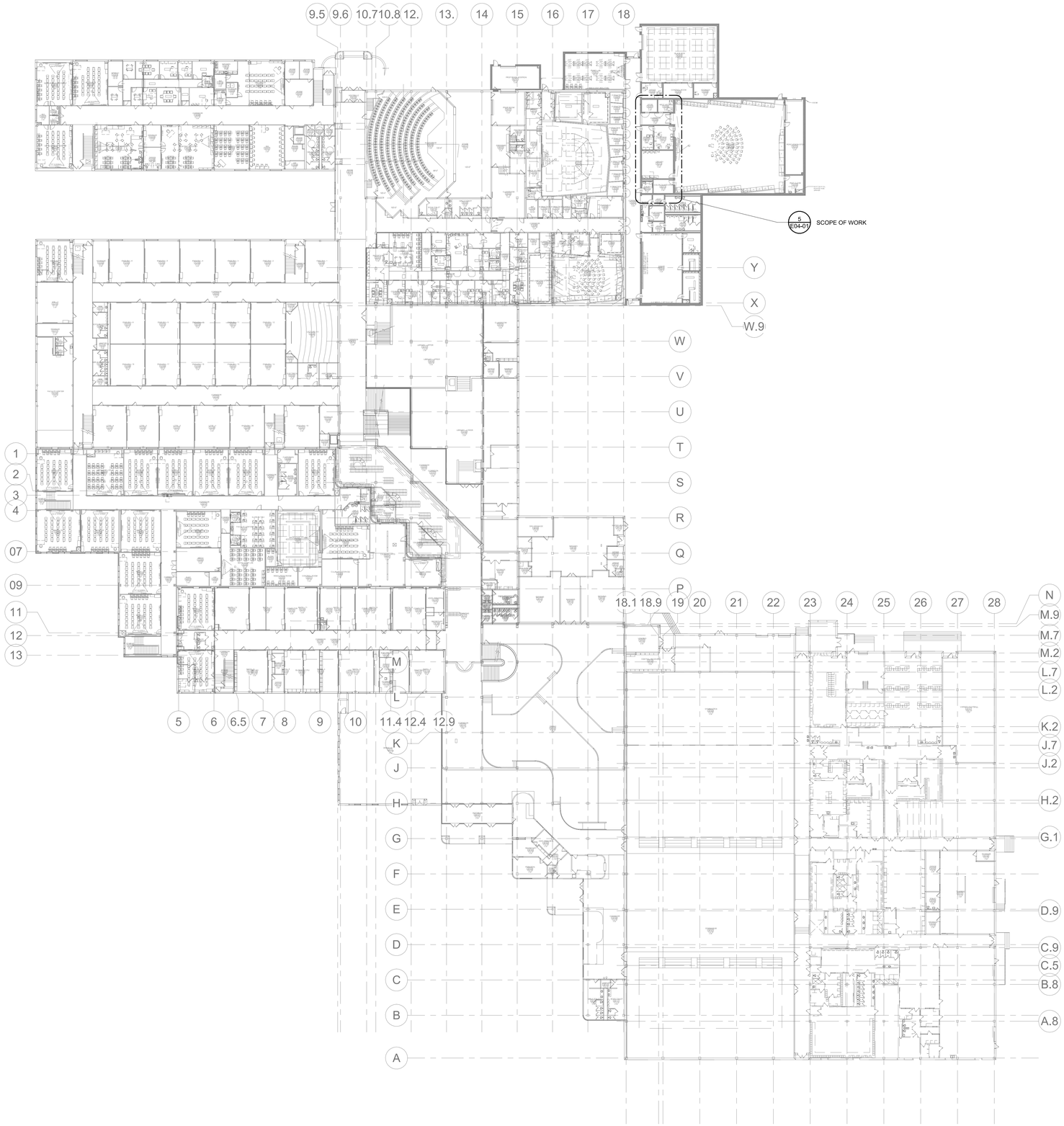
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DATE	02/26/26

FIRST FLOOR REFERENCE POWER PLAN

E01-01



1 ELECTRICAL SECOND FLOOR PLAN
1" = 30'-0"

2/25/2026 2:38:35 PM E01-02 SECOND FLOOR REFERENCE POWER PLAN

Deadline: March 31, 2026 - 2:30 PM

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SECOND FLOOR REFERENCE POWER PLAN

E01-02

LIGHT FIXTURE SCHEDULE

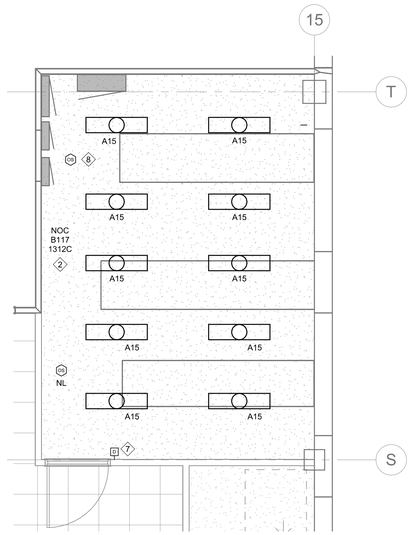
ELECTRICAL

FIXTURE LETTER	FIXTURE STYLE	VOLTAGE	MOUNTING	LAMPS TYPE	LAMPS COLOR	BALLAST/ DRIVER	FIXTURE MAX VA	CONTROL MEDIA (LENS, LOUVER, ETC.)	MANUFACTURER'S SERIES NUMBER	FIXTURE DESCRIPTION	NOTES
A15	1' X 4' LINEAR RECESSED CLEAN ROOM	120/277	OVERLAP FLANGE MOUNT	LED 3000 LUM MIN	3500K	DIMMING 0-10V (10%)	24 VA	CLEAR POLYCARBONATE	SRTL F L48 3000LM OAW PCL125 MVOLT GZ1 35K 80CRI	CONTINUOUS WHITE ALUMINUM HOUSING	
FLG	SMALL FLOOD LIGHT WITH EMERGENCY BATTERY PACK	120/277	SURFACE	LED 5200 LUM MIN	4000K	NON-DIMMING	37 VA	FORWARD THROW MEDIUM DISTRIBUTION	LITHONIA DSXW 1LED P5 40K 80CRI TFTM MVOLT E20WC DDBXD	DIE-CAST ALUMINUM HOUSING, POWDER COAT FINISH, IP66 RATED.	

GENERAL ELECTRICAL NOTES:

A. REFER TO SPECIFICATION SECTIONS 265100 AND 265600 FOR LIGHT FIXTURE REQUIREMENTS.
B. BRING CONFLICTS BETWEEN THE MANUFACTURER'S CATALOG NUMBER AND DESCRIPTIONS TO THE ATTENTION OF THE ENGINEER.
C. LIGHT SOURCE SHALL HAVE COLOR TEMPERATURE 3500K WITH MINIMUM CRI OF 80 UNLESS OTHERWISE NOTED.
D. UNLESS A SPECIFIC CATALOG NUMBER OR SERIES IS NAMED, THE MANUFACTURER'S NAMED ALTERNATES MUST SUBMIT CATALOG CUT SHEETS AND IES FORMATTED PHOTOMETRIC REPORT TO THE ENGINEER FOR APPROVAL AT LEAST 10 DAYS PRIOR TO BID DATE. THE ENGINEER MAY REQUEST SAMPLE OF LUMINAIRE TO BE SUPPLIED.
E. MINIMUM LUMENS LISTED FOR LIGHT FIXTURES ARE DELIVERED LUMENS BASED ON PHOTOMETRIC TESTING COMPLETED IN ACCORDANCE WITH IES LM-79 STANDARDS.
F. SUBSTITUTE LIGHT FIXTURE IS SUBJECT TO ARCHITECT/ENGINEER APPROVAL.

NOTES:



1 NOC REFLECTED CEILING PLAN
1/4" = 1'-0"

KEY NOTES:

1. PROVIDE 500KW GENERATOR IN PLACE OF EXISTING. REFER TO SHEET E04-01, DETAIL #2 FOR ADDITIONAL GENERATOR INFORMATION.
2. REINSTALL ALL EXISTING CEILING MOUNTED FIRE ALARM EQUIPMENT AND COMMUNICATIONS EQUIPMENT IN THE NOC ROOM THAT WERE MOVED DURING DUCTWORK RELOCATION.
3. FEED ROOF TOP UNITS FROM NEW BREAKERS IN EXISTING SOURCE PANEL EHNOC. FOR PANEL LOCATION, SEE SHEET E04-01, DETAIL #3.
4. MOUNT DISCONNECT SWITCH ON ROOF-MOUNTED UNISTRUT RACK.
5. GENERATOR DOCKING STATION. REFER TO SHEET E04-01, DETAIL #2 FOR ADDITIONAL INFORMATION.
6. PROVIDE PEAK DEMAND AMPERAGE METER READING IN TABLE FORMAT TO ENGINEER FOR REVIEW. PROVIDE MAXIMUM DEMAND AMPERAGE METER READING (MEASURE OF AVERAGE POWER DEMAND OVER A 15-MINUTE PERIOD) CONTINUOUSLY RECORDED OVER 30-DAYS USING A POWER METER PER 2023 NEC 220.87.
7. UTILIZE EXISTING LIGHTING BRANCH CIRCUIT MADE AVAILABLE BY DEMOLITION. REPLACE SWITCH WITH 0-10V DIMMING SWITCH COMPATIBLE WITH EXISTING LIGHTING CONTROLS SYSTEM.
8. INSTALL A SECOND OCCUPANCY SENSOR, MATCHING EXISTING.
9. PROVIDE 120V BRANCH CIRCUIT CONNECTION TO MOTORIZED DAMPERS.
10. PROVIDE 120V BRANCH CIRCUIT CONNECTION TO LOAD BANK DUMP.
11. PROVIDE 120V, 2P BREAKER TO 3/4"C, 2#10 + #10 G BRANCH CIRCUIT TO GENERATOR BLOCK HEATER.
12. PROVIDE 120V BRANCH CIRCUIT CONNECTION TO GENERATOR BATTERY CHARGER.

GENERAL NOTES:

A. REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHTS, EXACT LOCATION OF ALL WIRING DEVICES, AND PHASING REQUIREMENTS.
B. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATIONS OF CEILING MOUNTED LIGHT FIXTURES.
C. CONTRACTOR TO PROVIDE LIGHTING COMMISSIONING FOR THIS PROJECT.
D. 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) REQUIRES COMMISSIONING PER SECTION 408.
E. PROVIDE ELECTRICAL SYSTEM FUNCTIONAL TESTING PER 2021 IECC 408.3.1 FOR THE FOLLOWING:
   - 408.3.1.1 OCCUPANT SENSOR CONTROL.
   - 408.3.1.2 TIME-SWITCH CONTROLS.
F. PROVIDE THE DOCUMENTATION REQUIRED PER 2021 IECC 408.3.2.
G. THE CONTRACTOR IS RESPONSIBLE FOR SCHEDULING AND COORDINATING ELECTRICAL FUNCTIONAL TESTING WITH THE COMMISSIONING AGENT PRIOR TO THE FINAL ELECTRICAL INSPECTION BY THE LOCAL AUTHORITY HAVING JURISDICTION.
H. NOTIFY THE COMMISSIONING AGENT AT A MINIMUM OF TWO WEEKS PRIOR TO PERFORMING EACH FUNCTIONAL TEST.
I. FIRE ALARM SYSTEM IS PERFORMANCE-BASED.

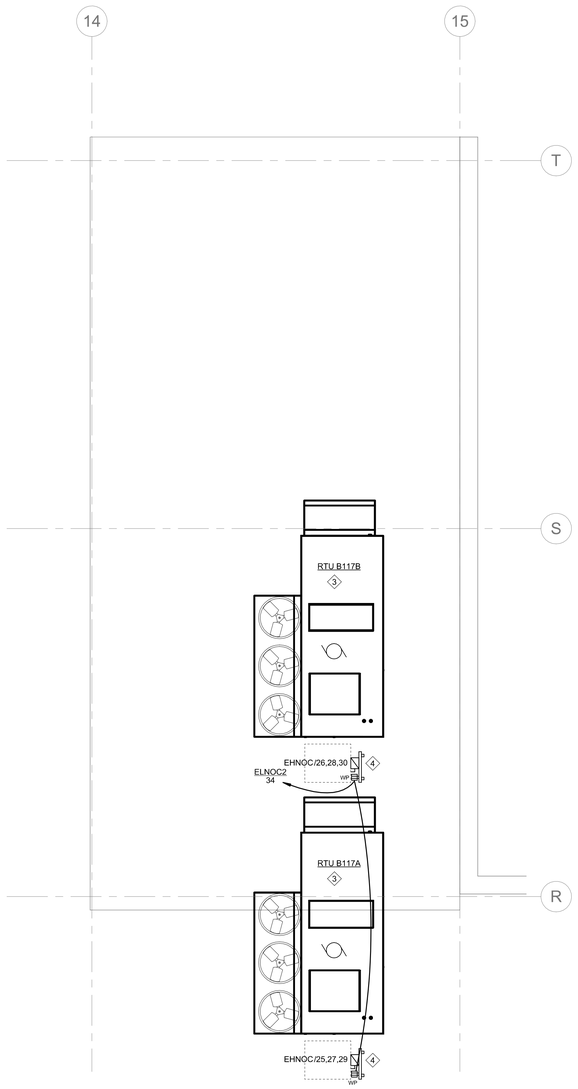
   CONNECT NEW OR RELOCATED FIRE ALARM DEVICES TO THE EXISTING FIRE ALARM SYSTEM. EXPAND AND MODIFY EXISTING FIRE ALARM SYSTEM TO ACCOMMODATE A COMPLETE WORKING FIRE ALARM SYSTEM.

   PROVIDE INTERFACE TO SERVE EGRESS DOORS TO AUTO RELEASE IN THE EVENT OF A FIRE ALARM.

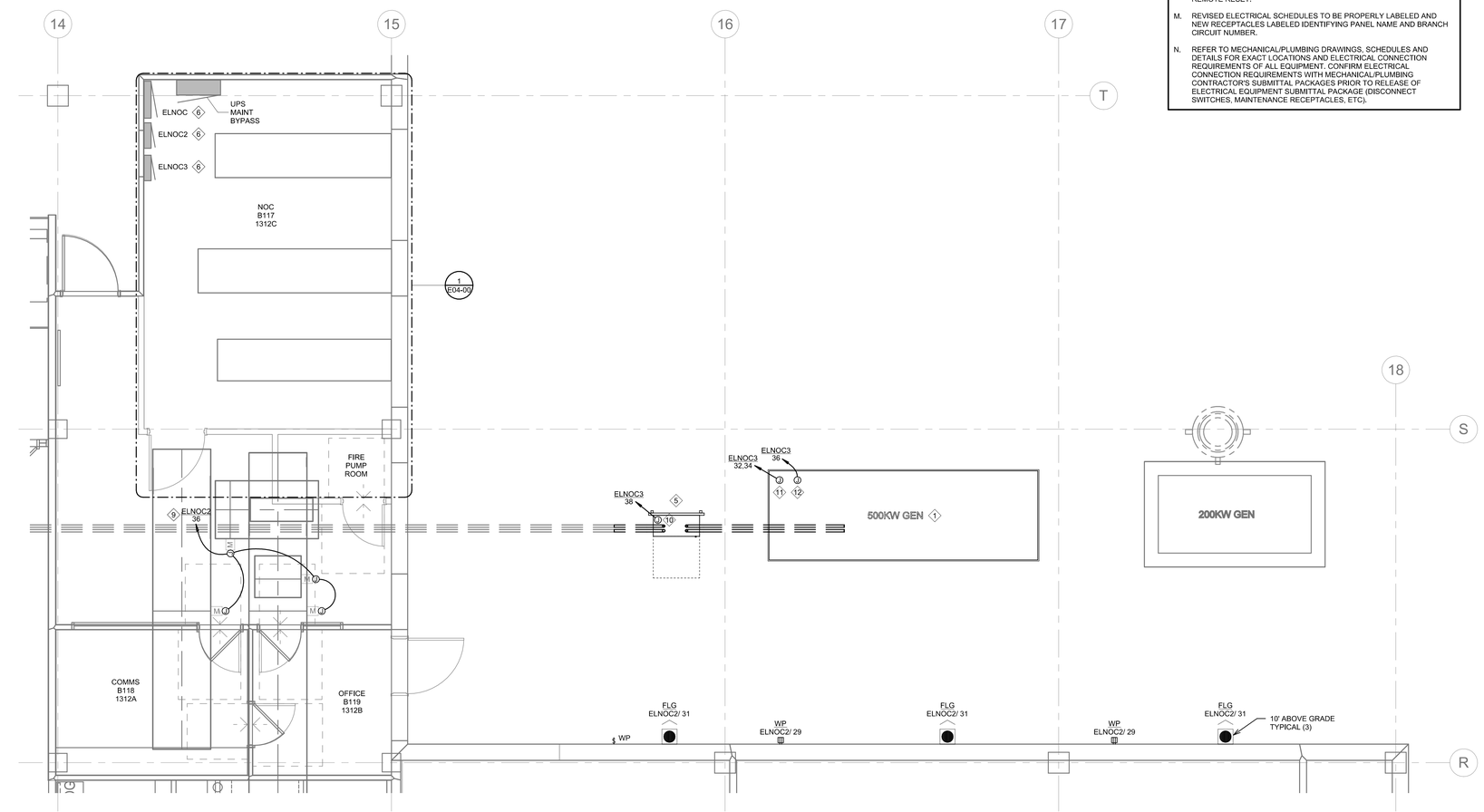
   PROVIDE DUCT SMOKE DETECTORS WITHIN 3' FROM FIRE/SMOKE DAMPERS.

   FIRST RESPONDER RADIO COVERAGE SHALL BE MET. CONFIRM MINIMUM RADIO SIGNAL STRENGTH WITH THIRD PARTY CONSULTANT/FIRE DEPARTMENT. PROVIDE BDA, DAS OR OTHER TYPE OF RADIO ENHANCEMENT SYSTEM (RES) PER FIRE DEPARTMENT REQUIREMENTS.

   PROVIDE 120V CONTROL REQUIREMENTS.
J. ALL CONDUCTORS SHALL HAVE AN INSULATION RATING OF 75°C.
K. RUN #10 AWG TO FIRST DEVICE OF CIRCUIT IN HOME RUNS BEYOND 75' IN DISTANCE.
L. PROVIDE GFCI PROTECTION FOR ALL SINGLE-PHASE RECEPTACLES RATED 150 V TO GROUND OR LESS, 50 A OR LESS AND THREE-PHASE RECEPTACLES RATED AT 150V TO GROUND OR LESS, 100 A OR LESS INSTALLED IN THE FOLLOWING LOCATIONS: (5) ROOFTOPS, (6) OUTDOORS, PER 2023 NEC 210.8 (B). WHERE GFCI WIRING DEVICES ARE NOT ACCESSIBLE PROVIDE GFCI CIRCUIT BREAKER OR GFCI REMOTE RESET.
M. REVISED ELECTRICAL SCHEDULES TO BE PROPERLY LABELED AND NEW RECEPTACLES LABELED IDENTIFYING PANEL NAME AND BRANCH CIRCUIT NUMBER.
N. REFER TO MECHANICAL/PLUMBING DRAWINGS, SCHEDULES AND DETAILS FOR EXACT LOCATIONS AND ELECTRICAL CONNECTION REQUIREMENTS OF ALL EQUIPMENT. CONFIRM ELECTRICAL CONNECTION REQUIREMENTS WITH MECHANICAL/PLUMBING CONTRACTOR'S SUBMITTAL PACKAGES PRIOR TO RELEASE OF ELECTRICAL EQUIPMENT SUBMITTAL PACKAGE (DISCONNECT SWITCHES, MAINTENANCE RECEPTACLES, ETC).



2 ELECTRICAL ROOF PLAN
1/4" = 1'-0"



3 NOC ROOM AND GENERATOR YARD
1/4" = 1'-0"

Deadline: March 31, 2026 - 2:30 PM

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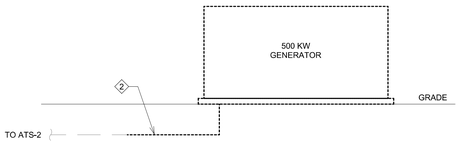
ROCKWALL NOC HVAC REFIT

901 W YELLOW JACKET LN
ROCKWALL, TX 75087

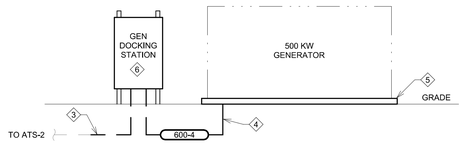
JOB	1326013-000-00
DATE	02/26/26

NOC ROOM POWER PLAN

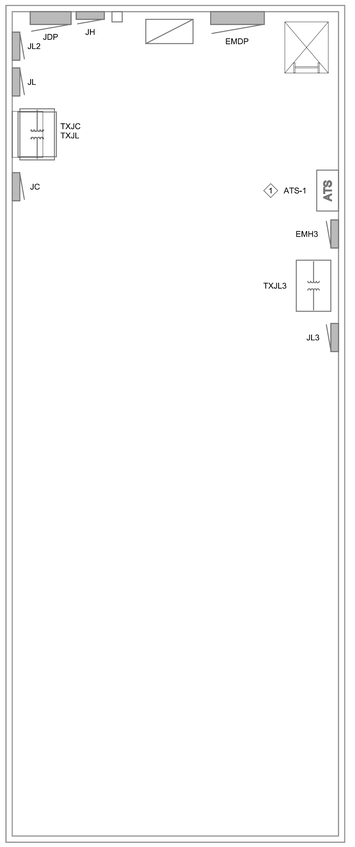
E04-00



1 500 KW GENERATOR DEMOLITION
NO SCALE



2 500 KW GENERATOR AND DOCKING STATION
NO SCALE



5 MEZZANINE ATS ROOM
1/4" = 1'-0"

DETAIL NOTES:

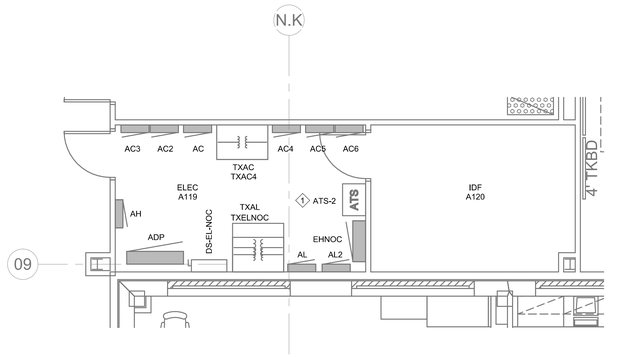
1. PROVIDE MECHANICAL LUG TERMINATIONS IN ENCLOSURE. SPLICES AND TAP CONNECTORS ARE NOT ACCEPTABLE.
2. PROVIDE PHASE (⌀) ROTATION LIGHTS ON TEMP GENERATOR SIDE OF CB WITH INTERNAL FUSING.
3. PROVIDE SINGLE BREAKER DESIGN WITH 2 SETS OF CAMLOCKS (FEMALE CONNECTION FOR LOAD BANK AND MALE CONNECTION FOR TEMP GEN), PROVIDE GROUNDING CAMLOCKS AND FOR PARALLELED SETS AS NECESSARY.
4. PORTABLE LOAD BANK MUST BE CAPABLE OF ACCEPTING LOAD DUMP SIGNAL
5. SELECTOR SWITCH BETWEEN PERMANENT GENERATOR AND TEMPORARY GENERATOR STARTING CONTACTS.
6. DETAILS SHOW INTENT; COMPLY WITH NEC AND COORDINATE WITH SUPPLIER AND MANUFACTURER
7. PROVIDE ENCLOSURE, EQUIPMENT, CONDUCTORS, MOUNTING HARDWARE, CONNECTORS AND CONNECTIONS, RACEWAY, AND ACCESSORIES AS NECESSARY.
8. ROUTE CONDUCTORS IN RACEWAY, SIZE PER NEC, OR AS SHOWN, WHICHEVER IS GREATER.

3 GENERATOR DOCKING STATION CONTROL DIAGRAM WITHOUT INTEGRAL CAM LOCK
NO SCALE

KEY NOTES:

1. TYPICAL CURRENT CARRYING CONDUCTOR TO TRANSFER SWITCHES.
2. NEUTRAL CONDUCTOR.
3. COPPER EQUIPMENT GROUNDING CONDUCTOR SIZED PER NEC 250.122.
4. REMOVE SUPPLY SIDE BONDING JUMPER, IF PRESENT AND CONNECTED.
5. SERVICE GROUNDING ELECTRODE CONDUCTOR.
6. MAIN SERVICE GROUNDING ELECTRODE SYSTEM.
7. NEUTRAL GROUND BAR.
8. EQUIPMENT GROUND BAR.
9. FEEDER DISCONNECT LOCATED IN GENERATOR ENCLOSURE.

4 GENERATOR GROUNDING DETAIL - GGD1
NO SCALE



6 ELECTRICAL ROOM A119
1/4" = 1'-0"

GENERAL NOTES:

A. REFER TO MECHANICAL/PLUMBING DRAWINGS, SCHEDULES AND DETAILS FOR EXACT LOCATIONS AND ELECTRICAL CONNECTION REQUIREMENTS OF ALL EQUIPMENT. CONFIRM ELECTRICAL CONNECTION REQUIREMENTS WITH MECHANICAL/PLUMBING CONTRACTOR'S SUBMITTAL PACKAGES PRIOR TO RELEASE OF ELECTRICAL EQUIPMENT SUBMITTAL PACKAGE (DISCONNECT SWITCHES, MAINTENANCE RECEPTACLES, ETC)

KEY NOTES:

1. PROVIDE PEAK DEMAND AMPERAGE METER READING IN TABLE FORMAT TO ENGINEER FOR REVIEW. PROVIDE MAXIMUM DEMAND AMPERAGE METER READING (MEASURE OF AVERAGE POWER DEMAND OVER A 15-MINUTE PERIOD) CONTINUOUSLY RECORDED OVER 30-DAYS USING A POWER METER PER 2020 NEC 220.87.
2. PARTIALLY PULL BACK GENERATOR POWER, ACCESSORY, AND CONTROL CABLES. CUT THE POWER AND ACCESSORY CONDUITS SO THAT THEY CAN BE REDIRECTED INTO A NEW GENERATOR DOCKING STATION. CUT THE CONTROL CONDUIT SO THAT IT CAN BE REDIRECTED INTO THE NEW GENERATOR. TEMPORARILY CAP THE CONDUITS TO PREVENT WATER INGRESS. PROTECT ALL REMAINING EQUIPMENT AND INFRASTRUCTURE DURING REMOVAL.
3. PROVIDE NEW POWER AND ACCESSORY CONDUITS AND ELBOWS TO EXTEND THE EXISTING POWER AND ACCESSORY CONDUITS TO THE GENERATOR DOCKING STATION, AND TO EXTEND THE EXISTING CONTROL CONDUIT TO THE GENERATOR. PULL THE EXISTING CABLES BACK INTO THE GENERATOR AND DOCKING STATION FOR CONNECTION. CONFIRM EXISTING CONDUIT SIZE. REPORT ANY DISCREPANCIES TO ENGINEER PRIOR TO CONSTRUCTION.

   BID ALTERNATE: PROVIDE SEPARATE LINE ITEM PRICING TO REPLACE 600A CONDUCTORS, MAKING CONNECTION WITH (2) 3 1/2"C, 4#350KCMIL + #1/0 G IN EXISTING CONDUIT.
4. INSTALL FEEDERS BETWEEN THE DOCKING STATION AND THE GENERATOR.
5. PROVIDE NEW CONCRETE PAD FOR GENERATOR. REFER TO STRUCTURAL ENGINEER FOR EXACT CONCRETE PAD REQUIREMENTS.
6. TRYSTAR SBDS-7 DOCKING STATION WITH KIRK KEY INTERLOCK, 600A MCB, 480V-3PH, NEMA 3R WITH LOAD BANK OUTLET. ACCESS TO CAMLOCK PANELMOUNT IS PREVENTED UNTIL MAIN GENERATOR CIRCUIT BREAKER IS OPENED.

   SEQUENCE OF OPERATIONS:
   -KIRK KEY IS HELD CAPTIVE AT GENERATOR MAIN BREAKER.
   -TURN OFF GENERATOR BREAKER AND REMOVE KEY
   -INSERT KIRK KEY TO OPEN DOCKING STATION CIRCUIT BREAKER TO ALLOW CONNECTION OF TEMPORARY GENERATOR CABLES.
   -KEY IS HELD CAPTIVE UNTIL ALL TEMPORARY POWER IS COMPLETE AND REMOVE KIRK KEY.
   -INSERT KIRK KEY TO CLOSE MAIN GENERATOR BREAKER TO RESUME NORMAL OPERATION.

FEEDER SCHEDULE

XXXX

FEEDER	FEEDER DESCRIPTION	CONDUIT
600-4	(2) 3 1/2"C, 4#350KCMIL + #1/0 G	EMT

FEEDER SUFFIX GUIDE

WIRE COUNT:		MODIFIERS:	
-2	TWO WIRE	SE	SERVICE ENTRANCE
-3	THREE WIRE	S	SECONDARY (LV TRANSFORMER)
-4	FOUR WIRE	D	SIZED FOR VOLTAGE DROP
		U	UNDERGROUND
		L	ALUMINUM
		N	ADDED NEUTRAL

GENERAL NOTES:

A. NOMENCLATURE DEFAULTS WITH A SINGLE NEUTRAL AND A GROUND.
B. UNLESS NOTED OTHERWISE, CONDUIT SIZES SHOWN ARE BASED ON EMT. IF USING OTHER CONDUIT TYPES, ADJUST SIZES ACCORDINGLY. REFER TO SPECIFICATIONS FOR DETAILED REQUIREMENTS.
C. CONDUIT TYPE IS BASED ON THE MAJORITY OF THE FEEDER ROUTING. WHERE TRANSITIONS ARE REQUIRED, SUCH AS FROM INTERIOR TO EXTERIOR LOCATIONS, REFER TO THE PROJECT SPECIFICATIONS FOR CONDUIT MATERIAL AND INSTALLATION REQUIREMENTS

NOTES:

Deadline: March 31, 2026 - 2:30 PM

CORGAN

DUNHAM

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PHONE 469.694.5700
WEB dunhameng.com
FIRM LICENSE NO. F-1115
mechanical + electrical
consulting engineering

	ISSUANCES
02/26/26	ISSUE FOR CONSTRUCTION

2026.02.25 14:52:25-06'00'

STATE OF TEXAS
JUSTIN A. THINER
158421
LICENSED
PROFESSIONAL ENGINEER
2/26/26

Date of issue:
02/26/26

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ROCKWALL NOC HVAC REFIT

901 W YELLOW JACKET LN
ROCKWALL, TX 75087

JOB 1326013-000-00
DATE 02/26/26

ENLARGED POWER PLANS AND DETAILS

E04-01

NAME: EHNOC

ENCLOSURE: NEMA 1 **SUPPLY FROM:** ATS-2 **VOLTAGE:** 277/480 **MIN. BUS RATING:** 600 A
MOUNTING: SURFACE **FEED THRU LUGS:** YES **PHASE:** 3 **MAIN SIZE:** MLO
INCOMING FEED: TOP **FTL SUB PANEL:** TXELNOC **WIRE:** 4 **MAIN OPTIONS:**
CALCULATED AFC: N/A

CKT	CIRCUIT DESCRIPTION	NOTE	TRIP	POLE	A		B		C		POLE	TRIP	NOTE	CIRCUIT DESCRIPTION	CKT
1	IN USE		20	1	0	0									2
3							0	0			3	60	*1*	***SPARE***	4
5	***SPARE***	*1*	60	3					0	0					6
7					0	0									8
9							0	0			3	20		SPARE	10
11	IN USE		20	3					0	0					12
13					0	0					1	20		SPARE	14
15	SPARE		20	1			0	0			1	20		SPARE	16
17	SPARE		20	1					0	0	1	20		SPARE	18
19	SPARE		20	1	0	0					1	20		SPARE	20
21	SPARE		20	1			0	0			1	20		SPARE	22
23	SPACE		--	1					--	0	1	20		SPARE	24
25					39628	39628									26
27	***RTU #B117A - 26.5 TON, THRU 200A DISCONNECT, 175A FUSES***	*1*	*175*	*3*			39628	39628			*3*	*175*	*1*	***RTU #B117B - 26.5 TON, THRU 200A DISCONNECT, 175A FUSES***	28
29									39628	39628					30
31	SPACE		--	1	--	--					1	--		SPACE	32
33	SPACE		--	1			--	--			1	--		SPACE	34
35	SPACE		--	1					--	--	1	--		SPACE	36
37	SPACE		--	1	--	--					1	--		SPACE	38
39	SPACE		--	1			--	--			1	--		SPACE	40
41	SPACE		--	1					--	--	1	--		SPACE	42

		A	B	C
THIS SECTION TOTAL:	**TOTAL LOAD:**	79257 VA	79257 VA	79257 VA
	TOTAL AMPS:	286 A	286 A	286 A
TOTAL LOAD CONNECTED TO FEED THROUGH LUGS:	**TOTAL LOAD:**	0 VA	0 VA	0 VA
	TOTAL AMPS:	0 A	0 A	0 A
PANEL GRAND TOTALS:	**TOTAL LOAD:**	79257 VA	79257 VA	79257 VA
	TOTAL AMPS:	286 A	286 A	286 A

LOAD CLASSIFICATION	CONNECTED LOAD (VA)	DEMAND FACTOR	LOAD DEMAND (VA)	TOTALS	
LIGHTING LOAD (DA_L)		125%			
RECEPTACLE LOAD (DA_R)		10 KVA @ 100%, Remaining @ 50%		**TOTAL CONN. LOAD:**	237770 VA
MTR LOAD - HEATING (DA_HM)		100%		**TOTAL EST. DEMAND:**	237770 VA
MTR LOAD - COOLING (DA_CM)		100%		**TOTAL CONN. CURRENT:**	286 A
MTR LOAD - GENERAL (DA_M)	237770 VA	100%	237770 VA	**TOTAL EST. DEMAND CURRENT:**	286 A
LARGEST MTR - BRANCH (DA_LBM)		125%	0 VA		
MOTOR LOAD TOTALS:	**237770 VA**		**237770 VA**		
KITCHEN LOAD (DA_K)		DEMAND PER NEC			
ELECTRONIC LOAD (DA_EL)		100%			
ELECTRIC HEATING (DA_E)		100%			
DWELLING UNIT - GEN. LOAD (DA_D)		10 KVA @ 100%, Remaining @ 40%			
MISCELLANEOUS LOAD (DA_MI)		100%			
SPARE CAPACITY (DA_SP)		100%			
NON-COINCIDENT (DA_NC)		0%			

GENERAL NOTES:
A. NEW CIRCUIT BREAKERS TO MATCH MANUFACTURER AND AIC RATING.
B.
C.

NOTES:
1. BOLD ITALICS INDICATE NEW REQUIREMENTS.
2.
3.
4.
5.
6.

NAME: ELNOC2

ENCLOSURE: NEMA 1 **SUPPLY FROM:** UPS MAINT BYPASS **VOLTAGE:** 120/208 **MIN. BUS RATING:** 225 A
MOUNTING: SURFACE **FEED THRU LUGS:** YES **PHASE:** 3 **MAIN SIZE:** 225 A
INCOMING FEED: TOP **FTL SUB PANEL:** ELNOC3 **WIRE:** 4 **MAIN OPTIONS:** MCB
CALCULATED AFC: N/A

CKT	CIRCUIT DESCRIPTION	NOTE	TRIP	POLE	A		B		C		POLE	TRIP	NOTE	CIRCUIT DESCRIPTION	CKT
1	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		COMPUTER OUTLETS - NOC 1312	2
3	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		COMPUTER OUTLETS - NOC 1312	4
5	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		COMPUTER OUTLETS - NOC 1312	6
7	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		COMPUTER OUTLETS - NOC 1312	8
9	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		COMPUTER OUTLETS - NOC 1312	10
11	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		COMPUTER OUTLETS - NOC 1312	12
13	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		COMPUTER OUTLETS - NOC 1312	14
15	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		COMPUTER OUTLETS - NOC 1312	16
17	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		COMPUTER OUTLETS - NOC 1312	18
19	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		COMPUTER OUTLETS - NOC 1312	20
21	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		COMPUTER OUTLETS - NOC 1312	22
23	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		COMPUTER OUTLETS - NOC 1312	24
25	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		IN USE	26
27	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		IN USE	28
29	***GEM MAINT RECEPTACLES***		*20*	*1*					0	0	1	30		IN USE	30
31	***GEM WALL LIGHTS***		*20*	*1*	111	0					1	30		IN USE	32
33	SPACE		--	1			--	0			*1*	*20*	*1*	***NOC RTU MAINT RECEPTACLES***	34
35									0	1000	*1*	*20*	*1*	***NOC DUCT DAMPER***	36
37	SPD		60	3	0	--					1	--		SPACE	38
39							0	--			1	--		UNAVAILABLE (FEED THRU LUGS)	40
41	UNAVAILABLE (FEED THRU LUGS)		--	1					--	--	1	--		UNAVAILABLE (FEED THRU LUGS)	42

		A	B	C
	TOTAL LOAD:	1111 VA	1000 VA	1600 VA
	TOTAL AMPS:	9 A	8 A	13 A

LOAD CLASSIFICATION	CONNECTED LOAD (VA)	DEMAND FACTOR	LOAD DEMAND (VA)	TOTALS	
LIGHTING LOAD (DA_L)	111 VA	125%	139 VA		
RECEPTACLE LOAD (DA_R)		10 KVA @ 100%, Remaining @ 50%		**TOTAL CONN. LOAD:**	3711 VA
MTR LOAD - HEATING (DA_HM)		100%		**TOTAL EST. DEMAND:**	3739 VA
MTR LOAD - COOLING (DA_CM)		100%		**TOTAL CONN. CURRENT:**	10 A
MTR LOAD - GENERAL (DA_M)	1000 VA	100%	1000 VA	**TOTAL EST. DEMAND CURRENT:**	10 A
LARGEST MTR - BRANCH (DA_LBM)		125%	0 VA		
MOTOR LOAD TOTALS:	**1000 VA**		**1000 VA**		
KITCHEN LOAD (DA_K)		DEMAND PER NEC			
ELECTRONIC LOAD (DA_EL)		100%			
ELECTRIC HEATING (DA_E)	2600 VA	100%	2600 VA		
DWELLING UNIT - GEN. LOAD (DA_D)		10 KVA @ 100%, Remaining @ 40%			
MISCELLANEOUS LOAD (DA_MI)		100%			
SPARE CAPACITY (DA_SP)		100%			
NON-COINCIDENT (DA_NC)		0%			

GENERAL NOTES:
A. NEW CIRCUIT BREAKERS TO MATCH MANUFACTURER AND AIC RATING.
B.
C.

NOTES:
1. BOLD ITALICS INDICATE NEW REQUIREMENTS.
2.
3.
4.
5.
6.

NAME: ELNOC3

ENCLOSURE: NEMA 1 **SUPPLY FROM:** ELNOC2 **VOLTAGE:** 120/208 **MIN. BUS RATING:** 225 A
MOUNTING: SURFACE **FEED THRU LUGS:** NO **PHASE:** 3 **MAIN SIZE:** 225 A
INCOMING FEED: RIGHT **FTL SUB PANEL:** NONE **WIRE:** 4 **MAIN OPTIONS:** MCB
CALCULATED AFC: N/A

CKT	CIRCUIT DESCRIPTION	NOTE	TRIP	POLE	A		B		C		POLE	TRIP	NOTE	CIRCUIT DESCRIPTION	CKT
1	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		SPARE	2
3	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		SPARE	4
5	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		SPARE	6
7	COMPUTER OUTLETS - NOC 1312		30	1	0	0					1	30		SPARE	8
9	COMPUTER OUTLETS - NOC 1312		30	1			0	0			1	30		SPARE	10
11	COMPUTER OUTLETS - NOC 1312		30	1					0	0	1	30		SPARE	12
13	SPARE		20	1	0	0					1	30		SPARE	14
15	SPARE		20	1			0	0			1	30		SPARE	16
17	SPARE		20	1					0	0	1	30		SPARE	18
19	SPARE		20	1	0	0					1	30		SPARE	20
21	SPARE		20	1			0	0			1	30		SPARE	22
23	SPARE		20	1					0	0	1	30		SPARE	24
25	SECURITY BOX NOC ROOM 1312		20	1	0	0					1	30		SPARE	26
27	UPS CHARGER PLUG		30	2			0	0			1	30		SPARE	28
29									0	0	1	30		SPARE	30
31	FIRE ALARM PANEL NOC RM 1312		20	1	0	1000					*2*	*30*	*1*	***GENERATOR BLOCK HEATER***	32
33	UPS CHARGER PLUG		30	2			0	1000							34
35									0	600	*1*	*20*	*1*	***GENERATOR BATTERY CHARGER***	36
37					0	0					*1*	*20*	*1*	***GEN LOAD BANK DUMP***	38
39	SPD		30	3			0	--			1	--		SPACE	40
41									0	--	1	--		SPACE	42

		A	B	C
	TOTAL LOAD:	1000 VA	1000 VA	600 VA
	TOTAL AMPS:	9 A	9 A	5 A

LOAD CLASSIFICATION	CONNECTED LOAD (VA)	DEMAND FACTOR	LOAD DEMAND (VA)	TOTALS	
LIGHTING LOAD (DA_L)		125%			
RECEPTACLE LOAD (DA_R)		10 KVA @ 100%, Remaining @ 50%		**TOTAL CONN. LOAD:**	2600 VA
MTR LOAD - HEATING (DA_HM)		100%		**TOTAL EST. DEMAND:**	2600 VA
MTR LOAD - COOLING (DA_CM)		100%		**TOTAL CONN. CURRENT:**	7 A
MTR LOAD - GENERAL (DA_M)		100%		**TOTAL EST. DEMAND CURRENT:**	7 A
LARGEST MTR - BRANCH (DA_LBM)		125%	0 VA		
MOTOR LOAD TOTALS:	**0 VA**		**0 VA**		
KITCHEN LOAD (DA_K)		DEMAND PER NEC			
ELECTRONIC LOAD (DA_EL)		100%			
ELECTRIC HEATING (DA_E)	2600 VA	100%	2600 VA		
DWELLING UNIT - GEN. LOAD (DA_D)		10 KVA @ 100%, Remaining @ 40%			
MISCELLANEOUS LOAD (DA_MI)		100%			
SPARE CAPACITY (DA_SP)		100%			
NON-COINCIDENT (DA_NC)		0%			

GENERAL NOTES:
A. NEW CIRCUIT BREAKERS TO MATCH MANUFACTURER AND AIC RATING.
B.
C.

NOTES:
1. BOLD ITALICS INDICATE NEW REQUIREMENTS.
2.
3.
4.
5.
6.

Deadline: March 31, 2026 - 2:30 PM

CORGAN

DUNHAM

DUNHAM
2100 Lakeside Blvd, Suite 450
Richardson, Texas 75082
PHONE 469.694.5700
WEB dunhameng.com
FIRM LICENSE NO. F-1115
mechanical + electrical
consulting engineering

ISSUANCES

02/26/26	ISSUE FOR CONSTRUCTION

2026.02.25 14:52:16-06'00'

STATE OF TEXAS
JUSTIN A. THINER
158421
LICENSED
PROFESSIONAL ENGINEER
2/26/26

Date of issue:
02/26/26

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ROCKWALL NOC HVAC REFIT

901 W YELLOW JACKET LN
ROCKWALL, TX 75087

JOB 1326013-000-00
DATE 02/26/26

PANEL SCHEDULES

E06-00

SHIPPING LABEL

This label should be affixed to the outside of the package when submitted in response to this request.

FROM: _____

_____

_____

Package _____ of _____

SHIP TO: Rockwall Independent School District
Attn: Jana Hunter, Director of Purchasing
1050 Williams Street
Rockwall, TX 75087

CONTENTS: BID RESPONSE
BID NUMBER: RFCSP 2526.03-003
BID TITLE: NOC HVAC
BID DUE DATE: March 31, 2026
TIME DUE: 2:30 P.M. (CST)

----------FOLD OR CUT HERE----------

FROM: _____

_____

_____

Package _____ of _____

SHIP TO: Rockwall Independent School District
Attn: Jana Hunter, Director of Purchasing
1050 Williams Street
Rockwall, TX 75087

CONTENTS: BID RESPONSE
BID NUMBER: RFCSP 2526.03-003
BID TITLE: NOC HVAC
BID DUE DATE: March 31, 2026
TIME DUE: 2:30 P.M. (CST)

Rockwall Independent School District
RFCSP 2526.03-003 NOC HVAC

OFFER FORM

This form should serve as the cover to all responses; failure to sign may result in disqualification.

The undersigned authorized representative of the responding company indicated below hereby acknowledges;

- They are authorized to enter into contractual relationship on behalf of the responding company;
- They have carefully examined this document in its entirety;
- They propose to supply any products/services submitted under this solicitation at the prices quoted and in strict compliance with all terms, policies and procedures, unless any exceptions are noted;
- They understand verbal orders are not authorized and no order should be initiated without an authorized purchase order signed by the Director of Purchasing and that non-compliance may result in non-payment;
- Any and all exceptions have been noted in writing in the response and that no other exception will be claimed;
- The accuracy of all certifications which accompany this offer;
- The stated organization is an equal opportunity employer;
- The organization has not been a party to any collusion among offer/vendors in restraint of freedom of competition by agreement to offer at a fixed price or to refrain from offering; or with any RISD employee, Board Trustee, or consultant as to quantity, quality, or price in the prospective contract, or in any terms of the prospective contract except in any authorized discussion(s) with RISD's Purchasing personnel; or in any discussions or actions between offer/vendors and any RISD employee, Board Trustee, or consultant concerning exchange of money or other things of value for special consideration in the award of this contract.
- The prices in this offer have been determined independently, without consultation, communication, or agreement for the purpose of restricting competition, as to any matter related to such prices, with any other vendor or with any competitor;
- Notice of award and/or any communication regarding an award will be submitted via RISD and not by any consultant, contractor or other party involved in this solicitation.

- Receipt of Addenda, or lack thereof:

None: _____ (initial)
1: _____ (initial) # 2: _____ (initial)
3: _____ (initial) # 4: _____ (initial)

Name of Company:	Date:
Signature of Authorized Rep:	Printed Name:
Position or Title:	Phone:
Email:	Fax:

RESPONDENT'S PROPOSAL

The undersigned has carefully examined the Request for Proposals, Contract Documents, Conditions of the Contract, the Specifications, the Drawings and any addenda to the Drawings and Specifications, the site, premises and all conditions affecting the work on the project listed above as prepared by Rockwall ISD. The undersigned proposes to furnish all labor, materials, services and equipment necessary to complete the entire work in strict accordance with the above documents for the following sum:

Description	LS	Amount
BASE BID Base scope as identified in construction documents		$
OWNER'S CONTINGENCY		$35,000.00
TOTAL BID:		$

VENDOR DATA

FOR PURCHASE ORDER: ORDERING ADDRESS INFORMATION		
Company Name:		
Address:		
City, State, Zip:		
Contact Person:		
Title:		
Phone | Fax:		
Email address:		
May we submit orders via email:		
Email address, if different:		

FOR PAYMENTS: REMITTANCE ADDRESS INFORMATION		
Company Name:		
Address:		
City, State, Zip:		
Contact Person:		
Title:		
Phone | Fax:		
Email address:		

FOR BID NOTIFICATIONS	
Contact Email:	

COOPERATIVE AGREEMENTS

If the vendor holds a contract with any of the following, please circle and provide contract number(s) as applicable.

Allied States	Choice Partners	CTPA	DIR	E&I	EPIC6	EPCNT	HGAC	Omnia Partners	PACE	Tarrant County	TASB Buy Board	TIPS

Contract Number(s):

REFERENCE SHEET
DO NOT LEAVE BLANK

REFERENCE 1

School District Name:		
Contact Name:		
Address:		
Phone | Fax:		
Email Address:		

REFERENCE 2

School District Name:		
Contact Name:		
Address:		
Phone | Fax:		
Email Address:		

REFERENCE 3

School District Name:		
Contact Name:		
Address:		
Phone | Fax:		
Email Address:		

**Please note: Some projects may require more attention to be given to historical projects of like scope, type, location, institute, etc. While it is not a requirement, the District prefers references be given for school districts of similar size to Rockwall ISD and the district may evaluate responses as a whole, based on references provided.*

VENDOR ACKNOWLEDGEMENTS

RESIDENT BIDDER

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident bidder underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the great of the following (1) the amount by which a resident bidder would be required to underbid the resident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located; or (2) the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which a majority of the manufacturing relating to the contract will be performed.

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in (1) the state in which the nonresident's principal place of business is located; or (2) a state in which the nonresident is a resident manufacturer.

This subchapter does not apply to a contact involving federal funds.

FELONY CONVICTION AND CRIMINAL HISTORY NOTICE

Texas Education Code, Section 44.034, Notification of Criminal History, Subsection (a), states, "a person or business entity that enters into a contract with a school district must give advance notice to the District if the person or owner or operator of the business entity has been convicted of a felony." The notice must include a general description of the conduct resulting in the conviction of a felony. Subsection (b) states, "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction." The district must compensate the person or business entity for services performed before the termination of the contract. Vendor is responsible for the performance of the persons, employees and/or sub-contractors. Vendor assigns to provide services for Rockwall ISD pursuant to this proposal on any and all Rockwall ISD campus or facilities. Vendor will not assign individuals to provide services at a Rockwall ISD campus or facility who have a history of violent, unacceptable, or grossly negligent behavior or who have a felony conviction, without the prior written consent of the Rockwall ISD Purchasing Department.

CONFIDENTIALITY DECLARATION

Any portion of the response considered to be confidential or contain proprietary information, or to contain trade secrets, must be marked accordingly. This designation may not necessarily guarantee the non-release of the information under the Public Information Act or as otherwise required by law, but does provide the District with a means to review the issues thoroughly and, if justified, request an opinion by the Attorney General's office prior to releasing any information requested under the Public Information Act.

INTER-LOCAL AGREMEENTS WITH OTHER SCHOOL DISTRICTS

Rockwall ISD is a member of the Central Texas Purchasing Alliance (CTPA) and the Education Purchasing Cooperative of North Texas (EPCNT), each serving as an alliance of over 100 school districts in Texas representing millions of students, sharing information, services and contractual opportunities. A list of member districts can be found on the RISD Purchasing webpage.

In support of this collaborative effort, all awards made by Rockwall ISD may be adopted by other active member districts in either (or both) of the identified entities. By adopting a contract from another member district, the adopting district has met the competitive bidding requirements established by the Texas Education Code, Section 44.031 (a)(4). While there is no obligation to participate, doing so will streamline the public purchasing process and cut costs to the public. It will also keep vendors from having to answer multiple bids for many school districts for the same product(s) or services, thereby saving the vendors resources.

All purchases by members and participants other than Rockwall ISD will be billed directly to that entity and paid by that entity. Rockwall ISD will not be responsible for another entity's debts. Each governmental entity will order its own materials/services as necessary and according their policies.

COMMITMENT TO PROVIDE INSURANCE

Bidder will be able to furnish a valid insurance certificate reflecting as Certificate Holder: Rockwall ISD, 1050 Williams Street, Rockwall TX 75087. The vendor shall provide and maintain insurance in a company rated no less than an "A" by A.M. Best Company.

Vendor is aware of all costs to provide insurance, will do so pending contract award, and will provide a valid insurance certificate as describe within this solicitation.

DEBARMENT OR SUSPENSION CERTIFICATION

Non-Federal entities are prohibited from contracting with or making sub-awards under covered transaction to parties that are suspended or debarred or whose principals are suspended or debarred. Covered transactions include procurement of goods or services equal to or in excess of $100,000. Vendors receiving individual awards of $100,000 or more and all sub-recipients must certify that the organizations and its principals are not suspended or debarred.

INDEMNIFICATION AND HOLD HARMLESS

Except as otherwise expressly provided, respondent shall defend, indemnify and hold RISD harmless from and against all claims, liability, loss and expenses, including reasonable costs, collection expenses, and attorney's fees incurred, which arise by reason of the acts or omissions of respondent, its agents or employees in the performance of its obligation under this contract.

STATEMENT OF COMPLIANCE/DEVIATION

Unless otherwise stated, this proposal complies with all specifications and/or scope of work contained in the solicitation document. Any deviations from any part of this solicitation shall be listed on a separate page as provided by the respondent with detailed conditions and information. RISD will consider any deviations in its evaluation, and reserves the right to accept or reject any bid based upon any deviations.

CONTRACTOR CERTIFICATION

If an employee of a contractor is covered under SB 9 the contractor must bear the burden of obtaining a national, fingerprint-based criminal history check. Under Section 22.0834 of the Education Code, the contractor is then required to certify to the district that the criminal history check has been performed. Under the statute SB 9, a contractor is required to conduct a criminal history review on an employee only when the following criteria has been met: 1) The employer has contracted with the district to provide services. 2) The particular employee will have continuing duties relating to the contract with the district. 3) The particular employee will have contact with students.

TOXIC CONTROL COMPLIANCE

Rockwall Independent School District has established Management Plans for ensuring a high level of environmental air quality through its Operations Department. All contractors performing construction projects for RISD must familiarize themselves with these Management Plans and comply prior to the beginning of any awarded construction project. RISD employees are available to review such plans and assist in interpretation and understanding its Asbestos Management Plans at any time prior to beginning construction.

Certification of non-use of Asbestos and Lead Containing Materials is required by all General and Sub-Contractors for all construction projects, by State and Federal regulations which RISD is subject to. Completion of this Affidavit is mandatory before final payment on a project will be made. Complete this certificate, have it notarized and submit it with your application for final payment, certifying that no materials used in conjunction with this project contain asbestos or lead in any form and that all Material Safety Data Sheets (MSDS) have been supplied to Owner before submitting application for final payment.

MWBE/HUB CERTIFICATION

A bidder/proposer that has been certified as a Minority/Women Business Enterprise (also known as "Historically Underutilized Business" or "HUB") is encouraged to indicate its MWBE certification status when responding to this Bid/Proposal. If so, please provide the Certificate Number and Name of Certifying Agency.

CERTIFICATION OF EQUAL EMPLOYMENT STATEMENT

It is the policy of the District not to discriminate on the basis of race, color, national origin, gender, limited English proficiency or handicapping conditions in its programs. Vendor agrees not to discriminate against any employee orapplicant for employment to be employed in the performance of this Contract, with respect to hire, tenure, terms, conditions and privileges of employment, or a matter directly or indirectly related to employment, because of age (except where based on a bona fide occupational qualification), sex (except where based on a bona fide occupationalqualification) or race, color, religion, national origin, or ancestry. Vendor further agrees that every subcontract entered into for the performance of this Contract shall contain a provision requiring non-discrimination inemployment herein specified, binding upon each subcontractor. Breach of this covenant may be regarded as a material breach of the Contract.

CERTIFICATION OF SECTION 2271.002 TEXAS GOVERNMENT CODE

This section applies to a contract that: (1) is between a governmental entity and a company with 10 or more full-time employees; and (2) has a value of $100,000 or more that is to be paid wholly or partly from public funds of the governmental entity. A governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott Israel; and (2) will not boycott Israel during the term of the contract.

CERTIFICATION OF SECTION 2252 TEXAS GOVERNMENT CODE

This section applies to contracts with companies engaged in business with Iran, Sudan, or foreign terrorist organization is prohibited. A governmental entity may not enter into a governmental contract with a company that is identified on a list prepared and maintained under Section 806.051, 807.051 or 2252.153. The comptroller shall prepare and maintain, and make available to each governmental entity, a list of companies known to have contracts with or provide supplies and services to a foreign terrorist organization.

CERTIFICATION OF SECTION 2276 TEXAS GOVERNMENT CODE

This section applies only to a contract that (1) is between a governmental entity and a company with 10 or more full-time employees; and (2) had a value of $100,000 or more that is to be paid wholly or partly from public funds of the governmental entity. Except as provided by Subsection (c), a governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that (1) does not boycott energy companies; and (2) will not boycott energy companies during the term of the contract.

CERTIFICATION OF SECTION 2274 TEXAS GOVERNMENT CODE

This section applies only to a contract that: (1) is between a governmental entity and a company with at least 10 full-time employees: and (2) has a value of at least $100,000 that is paid wholly or partly from public funds of the governmental entity. Except as provided by Subsection (c) and Section 2274.003, a governmental entity may not enter into a contract with a company for the purchase of goods or services unless the contract contains a written verification from the company that it: (1) does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association; and (2) will not discriminate during the term of the contract against a firearm entity or firearm trade association. Subsection (b) does not apply to a governmental entity that (1) contracts with a sole-source provider; or (2) does not receive any bids from a company that is able to provide the written verification required by that subsection.

CERTIFICATION OF SECTION 2273 TEXAS GOVERNMENT CODE

A governmental entity may not enter into a taxpayer resource transaction with an abortion provider or an affiliate of an abortion provider. This subsection does not apply to a taxpayer resource transaction that is subject to a federal law in conflict with Subsection (a) as determined b by the executive commissioner of the Health and Human Services Commission and confirmed in writing by the Attorney General.

CERTIFICATION OF SECTION 2274 TEXAS GOVERNMENT CODE

A governmental entity may not enter into a contract or other agreement relating to critical infrastructure in this state with a company that is (1) owned by or the majority of stock or other ownership interest of the company is held or controlled by (a) individuals who are citizens of China, Iran, North Korea, Russia, or a designated country; (b) a company or other entity, including governmental entity, that is owned or controlled by citizens of or is directly controlled by the government of China, Iran, North Korea, Russia, or a designated country; or (2) headquartered in China, Iran, North Korea, Russia, or a designated country.

CONFLICT OF INTEREST

Effective January 1, 2006, any person or entity who contracts or seeks to contract with RISD for the sale or purchase of property, goods, or services (as well as agents of such persons) (hereafter referred to as Vendors) are required to file a Conflict of Interest Questionnaire with the District. Each covered person or entity who seeks to or who contracts with RISD is responsible for complying with any applicable disclosure requirements. Forms received by the District become public records immediately and the law requires school districts that maintain web sites to place these records on the District's web site.

The Conflict of Questionnaire must be filed no later than the seventh business day after the date that the vendor begins contract discussions or negotiations with the government entity, or submits to the entity an application, response to a request for proposal or bid, correspondence, or other writing related to a potential agreement with the entity.

The vendor also shall file an updated questionnaire not later than September 1 of each year in which a covered transaction is pending, and the seventh day after the date of an event that would make a statement in the questionnaire incomplete and inaccurate.

Note: A vendor is not required to file an updated questionnaire if the person had filed an updated statement on or after June 1, but before September 1 of the year.

Completed forms should be sent to Rockwall Independent School District Purchasing Department, 1050 Williams Street, Rockwall, Texas 75087. Forms are available from the Texas Ethics Commission website.

The Rockwall ISD website provides a list of Local Government Officers, Superintendent and other Personnel

IRS FORM W9

This is a required form by the IRS for government entities that pay vendors in excess of $600.00 annually in order to issue a 1099 form and is required in conjunction with the reporting requirements by the Internal Revenue Service.

Please include a current W9 with vendor's response.

Vendor affirms they have read all certifications as described in this section and agrees to comply with all federal, state, and local laws, rules, regulations and ordinances, as applicable. It is further acknowledged the vendor certifies compliance with all provisions, laws, acts, regulations, etc. as specifically noted.

Company Name:	
Federal Tax ID #:	
City, State, Zip:	
Phone Number:	
Printed Name of Authorized Representative:	
Title of Authorized Representative:	
Email Address:	
Signature of Authorized Representative:	
Date Signed:	

SAMPLE

ROCKWALL INDEPENDENT SCHOOL DISTRICT
STANDARD FORM OWNER/CONTRACTOR AGREEMENT
NOC HVAC Renovation Project

ROCKWALL INDEPENDENT SCHOOL DISTRICT
STANDARD FORM OWNER/CONTRACTOR AGREEMENT
NOC HVAC Renovation Project

THIS AGREEMENT made and entered into on <Month> _____, <Year> by and between the **Rockwall Independent School District** called **"District,"** and (Insert Name), herein called **"Contractor."**

The Owner's authorized representative is:

David Carter, CPA
Senior Chief Financial Officer
Rockwall Independent School District
1050 Williams Street
Rockwall, TX 75087
Phone number: (469) 698-7149

The term "Owner" means the Rockwall Independent School District or the Owner's authorized representative.

And the Contractor is: (Insert Name)

(Insert Address)

(Insert Address)

The Contractor's authorized representative is: (Insert Name and Title)

Phone number: (Insert Contact Number)

The Project is:

RFCSP 2526.XX-XXX
This project is to replace, the existing HVAC system and ceiling at the district's network operations center.

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W I T N E S E T H:

The Owner and Contractor agree as follows:

I. THE CONTRACT DOCUMENTS.

The Contract Documents consist of this Standard form Owner/Contractor Agreement (the "Agreement"), all sections of the Project Manual, including Drawings, Specifications, and Addenda issued prior to execution of this Agreement, the Owner's Request for Proposals and Contractor's Proposal documents submitted in response to such Request, modifications to the Agreement issued and agreed to by the parties subsequent to the execution of this Agreement, and other documents as may be listed in this Agreement. A Modification is (1) a written amendment to the Agreement signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the work issued by the Owner, and Architect, all of which must be signed by the parties. The Project Manual is a volume assembled for the work that is to be done on or relating to the Project (the "Work") which includes the bidding requirements, sample forms, Conditions of the Contract and Specifications.

In the event of conflict, terms and conditions contained in this Agreement shall take precedence over terms and conditions contained in the Project Manual, and the terms and conditions in the Project Manual, shall take precedence over all other terms and conditions contained in the other Contract Documents, unless specifically agreed otherwise herein.

The Contract Documents form the Contract for Construction (the "Contract"). The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a written Modification signed by Contractor, approved by Owner's Board of Trustees, and signed by the representative of Owner's Board of Trustees who is authorized to sign contracts. As a material consideration for the making of the Contract, modifications to the Contract shall not be construed against the maker of said modifications. The Contract Documents shall not be construed to create a contractual relationship of any kind (l) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor.

II. DATE OF COMMENCEMENT, FINAL COMPLETION, AND LIQUIDATED DAMAGES.

A. The date of commencement is the date to be fixed in a written Notice to Proceed (NTP) issued by the Owner, which shall be not later than April 21, 2026. The NTP date is dependent upon the awarded contractor returning executed contracts and insurance/bonds, if required, prior to this date.

B. The Contractor shall achieve Final Completion of the entire Project not later than July 31, 2026, subject to adjustments as provided in the Contract.

SAMPLE

C. The Contractor and his surety or sureties shall be liable for and shall pay to the Owner the sum of $1,000.00 per day as fixed, agreed and liquidated damages for each calendar day after the date specified in Paragraph 2(b), as adjusted by written amendment, until Final Completion of the Project. The amount of damage to the Owner for delay in completion of the Project is difficult to ascertain and the amount of liquidated damages per calendar day is reasonable anticipated pecuniary damages for such delay and is not a penalty. Neither an extension of time nor the collection of liquidated damages shall limit or exclude any other right or remedy of the Owner under provisions of the Contract.

III. CONTRACT SUM.

The Owner shall pay the Contractor for the Contractor's full performance of the Contract, the Contract Sum of (Insert Contract Amount) (the "Contract Sum") subject to additions, deductions and/or liquidated damages as provided in the Contract.

The Contract Sum contains an Owner's Contingency in the amount of $35,000.00. This contingency is for the sole use of the Owner to be used for changes in the scope of the Work and for the betterment of the Project. Owner's authorized representative may approve any expenditure from Owner's Contingency without further Board of Trustees approval. If the Owner's Contingency is not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating final payment.

IV. PROGRESS PAYMENTS.

A. Based upon Applications for Payment submitted to the Owner by the Contractor, the Owner will make progress payments as provided below.

B. Provided an Application for Payment is received and approved by the Owner not later than the twentieth (20th) day of a month, the Owner will make payment of the amount due, less five percent (5%) retainage, to the Contractor not later than the tenth (10th) day of the following month. If an Application for Payment is received by the Owner after the application date fixed above, payment in such amount as determined by Owner will be made by the Owner not later than fifty-one (51) days after the Owner receives and approves the Application for Payment.

C. Based on the Owner's observations and evaluations of the Project and the Contractor's Applications for Payment, the Owner will determine the amounts due to Contractor. If Owner determines, in Owner's reasonable discretion, that Contractor's Application for Payment contains discrepancies and/or errors, then Contractor shall resubmit said Application for Payment and the timeframe set forth in Section IV(B) above shall restart and apply from the date of resubmittal.

D. Any payment for undisputed amounts not paid in the time specified in paragraph 4.b. above shall be overdue. An overdue payment bears interest at the legal rate established by the Texas Government Code, §2251.025.

V. FINAL PAYMENT.

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A. Final payment, constituting the entire unpaid balance of the Contract Sum (less any offsets or damages as provided in the Contract Documents), will be made by the Owner when:

1. the Contract has been fully performed by the Contractor as determined by Owner, and Architect, and
2. the completed Project has been accepted by the Rockwall ISD Board of Trustees or its designee.

B. Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner:

1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Project have been paid or otherwise satisfied,

2. a certificate evidencing that the required insurance will remain in force after final payment and will not be cancelled or allowed to expire until at least 30 days' prior written notice has been given to the Owner,

3. a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Owner,

4. consent of surety to final payment,

5. other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and

6. written warranties and other documents required by the Contract and submitted to the Owner's Superintendent of Schools.

C. Acceptance of final payment by the Contractor shall constitute a waiver of all claims by the Contractor, except those previously made in writing and identified by the Contractor as unsettled at the time of final Application for Payment.

VI. OBLIGATIONS OF CONTRACTOR.

A. REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR.

Before ordering materials or equipment or commencing the Project, the contractor shall carefully:

1. study and compare the Contract Documents with each other and with other information furnished by Owner,

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2. verify all indicated dimensions,

3. take field measurements,

4. verify field conditions, and

5. compare the field measurements and conditions and other information known to the Contractor with the Contract Documents, and verify that there are no impediments to the Project being constructed at the proposed site.

Errors, inconsistencies or omissions discovered shall be reported in writing to the Owner, and Architect at once. In the event that discrepancies occur between ordered material and actual conditions, of which the Owner, and Architect were not notified beforehand, costs to correct such discrepancies shall be borne by Contractor.

B. **SUPERVISION AND CONSTRUCTION PROCEDURES.**

1. The Contractor shall supervise and direct the Project, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Project under the Contract, unless the Contract gives other specific instructions concerning these matters.

2. The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Project under a contract with the Contractor.

3. On trench excavations in excess of five feet in depth, Contractor shall bear sole responsibility for design and execution of acceptable trenching and shoring procedures as may be required by law, including but not limited to Texas Government Code §2166.303, Texas Health & Safety Code, Subchapter C, §756.021, *et seq.*, and OSHA 1926.652-.653. Contractor shall pay a qualified engineer to prepare detailed plans and specifications directing Contractor in safe execution of trenching and shoring.

C. **LABOR AND MATERIALS.**

1. Unless otherwise provided in the Contract, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Project, whether temporary or permanent and whether or not incorporated or to be incorporated in the Project.

2. The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. As part of that responsibility, Contractor shall enforce the Owner’s alcohol-free, drug-free, tobacco-free, and weapon-free policies and zones, which will require compliance with

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those policies and zones by Contractor's employees, Subcontractors, and all other persons carrying out the Contract. Contractor shall also require adequate and appropriate dress of Contractor's employees, Subcontractors, and all other persons carrying out the Contract.

Contractor further agrees to submit any of its employees, agents, subcontractors or sub-subcontractors or their respective employees and agents, who meet the requirements of a covered employee under Texas Education Code §22.0834, to national criminal history checks or, alternatively, agrees to keep such employees and agents from having any direct contact with students of Owner. Failure to comply with the requirements of Texas Education Code §22.0834 shall constitute an immediate event of default by Contractor. Further, Contractor shall complete the "Contractor Certification" attached hereto as Exhibit "A" before beginning any Work that is the subject of this Agreement.

3. Contractor shall at all times maintain job records, including, but not limited to, invoices, payment records, payroll records, daily reports, logs, diaries, and job meeting minutes, applicable to the Project. Owner reserves the right to audit contractor's books and records relevant to all services provided under the Contract Documents. In the event such audit reveals any errors resulting in overpayments by the Owner, Contractor shall refund Owner the full amount of such overpayment within thirty (30) days of such audit findings, or the Owner, at its option, reserves the right to withhold such amounts owing the Owner from any payments due the Contractor. Contractor shall make such reports and records available to inspection or audit by the Owner and/or its agents within five (5) working days of request by Owner or its agent. Such records shall be maintained by Contractor for at least four (4) years.

D. **WARRANTY.**

The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract, that work on the Project shall be performed in a good and workmanlike manner, that the Project will be free from defects not inherent in the quality required or permitted, and that the Project will conform with the requirements of the Contract. The contractor shall furnish the Contractor's warranty covering material and workmanship for a period of one year from the commencement date of the substantial completion. Manufacturer's material warranties shall be as issued by each manufacturer and provided in the close-out documentation.

E. **TAXES.**

The Owner qualifies for exemption from State and Local Sales Tax pursuant to the provisions of Chapter 151 of the Tax Code of the State of Texas. The Contractor may claim exemption from payment of applicable State and Local Sales Taxes by complying with such procedures as may be prescribed by the State Comptroller of Public Accounts. However, the Contractor shall pay all necessary local, county and state taxes, compensation tax, social security and withholding payments as required by law. **THE CONTRACTOR SHALL INDEMNIFY AND SAVE HARMLESS THE OWNER OF AND FROM ALL**

SAMPLE

CLAIMS AND DEMANDS MADE BY FAILURE OF THE CONTRACTOR OR SUBCONTRACTORS TO COMPLY WITH THE PROVISIONS OF ANY OR ALL SAID LAWS AND AMENDMENTS.

F. **PERMITS, FEES AND NOTICES.**

1. The Contractor shall secure and pay for the building permit and other permits, governmental fees and licenses necessary for proper execution and completion of the Project which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

2. The Contractor shall comply with, give notices and provide certifications as may be required by applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the Project including, but not limited to, 19 T.A.C. §61.1036.

G. **USE OF SITE.**

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract, as designated by the Owner, and shall not unreasonably encumber the site with materials or equipment.

H. **CLEANING UP.**

The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Project the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. If the Contractor fails to clean up as provided in the Contract, the Owner may do so and the cost thereof shall be charged to the Contractor and may be offset against any amounts still owed to the Contractor.

I. **INDEMNIFICATION.**

TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER, ITS TRUSTEES, AGENTS AND EMPLOYEES FROM AND AGAINST ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES INCLUDING BUT NOT LIMITED TO, ATTORNEYS' FEES, ARISING OUT OF OR RESULTING FROM CONSTRUCTION OF THE PROJECT, BUT ONLY TO THE EXTENT CAUSED IN WHOLE OR IN PART BY ACTS OR OMISSIONS OF THE CONTRACTOR, A SUBCONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THE CONTRACTOR OR SUBCONTRACTORS OR ANYONE ELSE FOR WHOSE ACTS THEY MAY BE LIABLE, UNLESS SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS CAUSED SOLELY BY A PARTY INDEMNIFIED HEREUNDER.

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THE OBLIGATIONS OF THE CONTRACTOR UNDER THIS SECTION SHALL NOT EXTEND TO THE LIABLITY OF THE ARCHITECT, THE ARCHITECT'S CONSULTANTS, OR AGENTS AND EMPLOYEES OF ANY OF THEM, CAUSED BY OR RESULTING FROM: (1) DEFECTS IN PLANS, DESIGNS OR SPECIFICATIONS PREPARED, APPROVED, OR USED BY THE ARCHITECT OR ENGINEER; OR, (2) NEGLIGENCE OF THE ARCHITECT OR ENGINEER IN THE RENDITION OR CONDUCT OF PROFESSIONAL DUTIES CALLED FOR OR ARISING OUT OF THE CONSTRUCTION CONTRACT IN THE PLANS, DESIGNS OR SPECIFICATIONS THAT ARE PART OF THE CONSTRUCTION CONTRACT; AND, (3) ARISING FROM: (A) PERSONAL INJURY OR DEATH; (B) PROPERTY DAMAGE; OR, (C) ANY OTHER EXPENSE THAT ARISES FROM PERSONAL INJURY, DEATH OR PROPERTY DAMAGE OR AS OTHERWISE LIMITED BY TEXAS CIVIL PRACTICE & REMEDIES CODE §130.001, ET SEQ.

FURTHER, AND IN ACCORDANCE WITH TEXAS INSURANCE CODE §151.102, AS APPLICABLE, THE OBLIGATIONS OF THE CONTRACTOR UNDER THIS SECTION SHALL NOT REQUIRE CONTRACTOR TO INDEMNIFY, HOLD HARMLESS, OR DEFEND THE PARTY(S) INDEMNIFIED HEREUNDER AGAINST A CLAIM CAUSED BY (I) THE NEGLIGENCE OR FAULT, (II) THE BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR (III) THE BREACH OF CONTRACT, OF THE OWNER, ITS AGENT OR EMPLOYEE OR ANY THIRD PARTY UNDER THE CONTROL OR SUPERVISION OF THE OWNER, OTHER THAN THE CONTRACTOR OR ITS AGENT, EMPLOYEE OR SUBCONTRACTOR OF ANY TIER.

J. **AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE PROJECT.**

1. The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the names of persons or entities proposed for each principal portion of the Project, if any. The Owner will promptly reply to the Contractor in writing stating whether or not the Owner, after due investigation, has reasonable objection to any proposed person or entity. Failure of the Owner to reply within ten (10) District business days shall constitute notice of no reasonable objection.

2. The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

3. If the Owner has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

SAMPLE

4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner makes reasonable objection to such change.

5. The Contractor shall not subcontract the Project as a whole. The approval of Subcontractors in no way relieves the Contractor from full responsibility.

6. Communications by and with Subcontractors and material suppliers shall be through the Contractor.

7. The Contract shall not be construed to create a contractual relationship of any kind:

a. between the Owner and a Subcontractor or Sub-subcontractor, or

b. between any persons or entities other than the Owner and Contractor.

K. **WORKERS' COMPENSATION.**

A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Department of Insurance, or a coverage agreement (DWC-81, DWC-82, DWC-83, or DWC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project is required for the duration of the Project.

Duration of the Project includes the time from the beginning of the Work on the Project until the Contractor's/person's work on the project has been completed and accepted by the Owner.

Persons providing services on the Project ("subcontractor" in Texas Labor Code §406.096) include all persons or entities performing all or part of the services the Contractor has undertaken to perform on the Project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity that furnishes persons to provide services on the Project.

Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. Services do not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code §401.011(44) for all employees of the Contractor providing services on the project for the duration of the Project.

The Contractor must provide a certificate of coverage to the Owner prior to being awarded the Contract.

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If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the Project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the Owner showing that coverage has been extended.

The Contractor shall obtain from each person providing services on a project, and provide to the Owner:

1. A certificate of coverage, prior to that person beginning work on the Project, so the Owner will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

2. No later than seven (7) days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.

The Contractor shall retain all required certificates of coverage for the duration of the Project and for one year thereafter.

The Contractor shall notify the Owner in writing by certified mail or personal delivery, within ten (10) days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

The Contractor shall post on each project site a notice, in the text, form, and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

1. Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code §401.011(44) for all of its employees providing services on the project for the duration of the Project;

2. Provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project for the duration of the Project;

3. Provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.

4. Obtain from each other person with whom it contracts, and provide to the Contractor:

SAMPLE

a. A certificate of coverage, prior to the other person beginning work on the Project; and

b. A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

5. Retain all required certificates of coverage on file for the duration of the Project and for one year thereafter;

6. Notify the Owner in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and

7. Contractually require each person with whom it contracts to perform as required by items 1-6, with the certificates of coverage to be provided to the person for whom they are providing services.

By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the Owner that all employees of the Contractor who will provide services on the Project will be covered by workers' compensation coverage for the duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor that entitles the Owner to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the Owner.

The coverage requirement recited above does not apply to sole proprietors, partners, and corporate officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996. 28 TAC §110.110(i).

L. **PAYMENT AND PERFORMANCE BONDS.**

In accordance with Texas Government Code §2253.021, the Contractor shall furnish, before beginning the Work, a Performance Bond in an amount equal to one hundred percent (100%) of the Contract Sum, if the Contract Sum meets or exceeds $100,000.00, to be used as security of the faithful performance of the Contract. The Contractor shall also furnish, before beginning the Work, a Payment Bond in accordance with Texas Government Code §2253.021, in an amount equal to one hundred percent (100%) of the Contract Sum, if the Contract Sum meets or exceeds $25,000.00, as security for the payment of all persons

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performing labor on the project under this Contract and furnishing materials in connection with the Contract. The Performance Bond, and the Payment Bond may be in one or in separate instruments in accordance with local law. Surety companies must be authorized to write surety bonds in Texas and any such surety bond must comply with the requirements Section 7.19-1, Texas Insurance Code. Proof of such Performance, and Payment shall be submitted to the Superintendent for his inspection and review prior to beginning any Work on the Project.

1. The Contractor shall deliver the required Bonds to the Owner not later than the date set in the Notice to Proceed. All Bonds will be reviewed by the District for compliance with the Contract Documents prior to the start of construction.

2. All Bonds shall be originals. The Contractor shall require the attorney-in-fact who executes the required Bonds on behalf of the Surety to affix thereto a certified and current copy of the power-of-attorney. The name, address and telephone number of a contact person for the Bonding Company shall be provided.

M. **CONTRACTOR'S INSURANCE.**

Contractor shall carry the following insurance with the minimum limits set forth herein. Such insurance must be carried with insurance companies acceptable to Owner. Contractor shall maintain such insurance, at its sole cost and expense, in full force and effect until this Contract has been fully performed, all equipment, implements and machinery of Contractor has been removed from, and all employees, agents, representatives and Subcontractors of Contractor have left Owner's premises and final payment of the Contract Sum is made, unless any such coverage is required pursuant to the terms of the Contract Documents to be maintained after all of the foregoing items have been completed. Contractor shall cause each insurance company (i) to issue the insurance on an occurrence basis; (ii) to provide defense as additional benefit and not within the limits of liability, (iii) to issue an endorsement to all policies that the policies are primary and that Owner's policies are excess, secondary and noncontributing, (iv) to issue an endorsement to all policies to provide a waiver of subrogation in favor of Owner, (v) to issue an endorsement to all policies, except the workers' compensation and employer's liability insurance policies, to include Owner and its trustees, officers, employees, and agents as "additional insureds," and, (vi) to include in each insurance policy a provision that the insurance company or companies shall not cancel, non-renew, or change coverage from the requirements of the Contract Documents without providing at least 30 days' advance written notice to Owner. The insurance company or companies shall not exclude from coverage the negligence, of the "additional insureds," unless such negligence is solely attributable to the conduct of an "additional insured." Contractor releases Owner and its trustees, officers, employees and agents from any liability covered by the insurance for which subrogation is waived. Contractor shall provide to Owner at least 30 days' advance written notice of any contemplated cancellation, non-renewal, or material reduction in insurance coverage. Contractor shall provide to Owner a certified copy of any and all insurance policies required in this Contract if Owner requests a copy.

SAMPLE

Insurance coverage shall be written for the greater of the following limits or as specified in Owner's RFP/CSP, or as required by law, if greater:

1. Employer's Comprehensive General Liability insurance with minimum limits of $1,000,000 for each employee for bodily injury by accident and for each employee for bodily injury by disease.

2. Commercial General Liability insurance, including liability for the Project and blanket coverage, Personal and Advertising Injury, Products-Completed Operations, Medical Payments, Bodily Injury, and Property Damage, with minimum limits of $300,000 per occurrence, $300,000 general aggregate, $300,000 products-completed operations aggregate, $50,000 fire damage (any one fire), and $5,000 medical expense. Contractor shall obtain an endorsement to each insurance policy to provide aggregate limits per location. Contractor shall cause each insurance company to delete any contractual liability exclusion with respect to the insurance, including insurance coverage for personal injury, hazards of explosion, collapse, fire, and underground property damage.

3. Business Automobile Liability insurance with minimum combined single limits of $1,000,000. Contractor shall cause each insurance company to provide coverage for liability arising out of the operation of owned, hired, and non-owned vehicles.

4. Contractual Liability insurance with minimum limits of $1,000,000 per occurrence, and $1,000,000 general aggregate. Contractor shall obtain an endorsement to each insurance policy to provide aggregate limits per location. The contractual liability insurance shall not be limited to coverage for the Indemnity, Waiver, and Obligation to Defend provisions in this Contract, but, instead, the contractual liability insurance shall cover all of Contractor's obligations to the fullest extent possible under the contractual liability endorsement. Further, the contractual liability insurance shall not limit, in any way, coverage provided to Owner and its trustees, officers, employees, and agents as additional insureds under each of Contractor's insurance policies.

5. Builder's Risk "all-risk" or equivalent insurance policy, including boiler and machinery insurance, in the amount of the initial Contract Sum plus the value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis. Coverage shall insure against the perils of fire, (with extended coverage) and physical loss or damage including, without limitation or duplication of coverage, lightning, collapse, earthquake, flood, wind storm, hurricane, hail, explosion, riot, civil commotion, smoke, aircraft, land vehicles, theft, vandalism, malicious mischief, falsework, testing and start-up, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and all other perils, and shall include materials stored on-site, off-site and in transit. Owner shall be a named insured under the policy, and the insurance shall also include the interests of Contractor, subcontractors, and sub-subcontractors. Contractor shall be responsible for maintaining said builder's risk insurance until the date of Final

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Completion. For any claim made against the builder's risk insurance, the deductible shall not exceed $2,500.

6. Umbrella/Excess Liability Insurance with minimum limits of $1,000,000. Contractor shall cause each insurance company to provide the insurance on an umbrella basis in excess over and no less broad than the liability coverages required in this Contract, with the same inception and expiration dates as Commercial General Liability insurance, and with coverage that "drops down" for exhausted aggregate limits under liability coverages in this Contract.

Contractor shall provide to Owner before the Work is started and at least 30 days prior to the expiration of a policy or policies of insurance in effect during the term of this Contract a certificate or certificates of insurance evidencing all required insurance in the Contract Documents and acceptable to Owner. All certificates, among other things, shall:

1. Show Owner as a certificate holder.

2. Show Contractor as the Named Insured.

3. Show the names of the insurance companies providing each coverage, the policy numbers of each coverage, and policy dates of each coverage.

4. Show the name of the person providing the certificate and that person's address and telephone number.

5. Contain the signature of an authorized representative of the person providing the certificate.

6. Show that each insurance company named Owner and its trustees, officers, employees, and agents as additional insureds in each insurance policy.

7. Show the primary status of each insurance policy.

8. Have attached copies of all required endorsements to each insurance policy, and not contain the phrases "endeavor to" and "but failure to mail such notice will impose no obligation or liability of any kind upon Company, its agents or representatives," or similar phrases and shall include the commitment that each insurance company shall issue each insurance policy to the named and additional insureds, that each policy is in full force and effect, and that each insurance company shall give to Owner at least 30 days' advance written notice, by certified mail, return receipt requested in the event of cancellation, non-renewal, or material reduction in coverage of any insurance policy.

Contractor shall not procure an insurance policy or policies with deductibles or self-insured retention in excess of $10,000 or with an endorsement restricting, limiting, or excluding coverage in any manner without Owner's prior written approval. Contractor shall pay all deductibles in the insurance that Contractor is required to provide under the Contract Documents.

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The Contractor shall purchase and maintain insurance covering the Owner's contingent liability for claims which may arise from operations under the Contract. This coverage can be afforded by adding Owner as additional insured on general liability insurance coverage.

Contractor's failure to procure and maintain the required insurance shall constitute a material breach of, and default under, this Contract. If Contractor fails to remedy the breach within five (5) days after notice from Owner, Owner may, in addition to any other remedy available to it, at its option, purchase the insurance, at Contractor's expense, or immediately terminate this Contract. Contractor shall Indemnify and Defend Indemnified Persons from and against any Claims Arising from Contractor's failure to procure and/or maintain the insurance.

N. **EQUAL EMPLOYMENT OPPORTUNITIES.**

Contractor acknowledges that Owner, as an independent school district, is a political subdivision of the State of Texas and has certain requirements concerning equal employment and affirmative action under state and federal law, and shall comply with all applicable laws, regulations and special requirements under such federal and state laws, and the Contract Documents regarding equal employment opportunity and affirmative action programs.

Contractor and Contractor's Subcontractors, if any, shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such actions shall include, but not be limited to, the following: 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 apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth policies of nondiscrimination.

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VII. OWNER'S RIGHTS AND REMEDIES.

A. OWNER'S RIGHT TO REJECT THE PROJECT AND TO REQUIRE TESTING.

The Owner may reject all or part of the Project which does not conform to the Contract. Whenever the Owner considers it necessary or advisable, the Owner may require additional inspection or testing of the Project. Owner reserves the right to withhold any Progress Payment or portion thereof for any non-conforming or inferior Work, and the cost of any additional testing associated with non-conforming portions of the Work shall be charged to the Contractor and may be offset against any amounts still owed to the Contractor.

B. **OWNER'S RIGHT TO STOP THE PROJECT.**

If Owner discovers any defective Work, including any portion of Work not constructed in accordance with the Contract Documents, Contractor shall promptly, without cost to the Owner, correct such defective Work. If Contractor fails to commence such corrections within a reasonable period of time, not to exceed thirty (30) days, and does not diligently continue the prosecution of such corrections, or if the Contractor persistently fails to do the Project in accordance with the Contract, the Owner, by written order, may order the Contractor to stop the Project, or any portion thereof, until the cause for such order has been eliminated.

C. **OWNER'S RIGHT TO CARRY OUT THE PROJECT.**

If the Contractor defaults or neglects to carry out the Project in accordance with the Contract and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case the Owner shall deduct from payments then or thereafter due the Contractor the cost of correcting such deficiencies. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

D. **TERMINATION BY THE OWNER FOR CAUSE.**

1. The Owner may terminate the Contract if the Contractor:

   a. persistently or repeatedly refuses or fails to do the work on the Project, or any part thereof, in accordance with the Contract and/or fails to supply enough properly skilled workers or proper materials;

   b. fails to make prompt payment to Subcontractors or for materials or labor;

   c. repeatedly disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction;

   d. otherwise is guilty of substantial breach of a provision of the Contract; or

   e. is adjudged bankrupt, makes a general assignment for the benefit of his creditors, or has a receiver appointed on account of its insolvency.

2. When any of the above reasons exist, the Owner may, but shall not be obligated to, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety seven days' written notice, terminate employment

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of the Contractor and may, but shall not be obligated to, subject to any prior rights of the surety:

a. take possession of the site and all materials, including tools, and construction equipment and machinery located thereon which have been leased by the Contractor on behalf of the Owner;

b. accept assignment of subcontracts; and/or

c. finish the Project by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 7(d)(1) above, the Contractor shall not be entitled to receive further payment until the Project is finished, if at all.

4. If the unpaid balance of the Contract Sum exceeds costs of finishing the Project, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be an obligation for payment which shall survive termination of the Contract.

E. **TERMINATION BY THE OWNER FOR CONVENIENCE.**

The Owner may, for convenience and without cause, terminate the Contract upon not less than seven (7) days' prior written notice to the Contractor. In the event of such termination for convenience and without cause, the Contractor shall be compensated for services performed prior to termination.

F. **SUSPENSION BY THE OWNER FOR CONVENIENCE.**

1. The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Project in whole or in part for such period of time as the Owner may determine.

2. An adjustment may be made for increases in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent:

a. that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

b. that an equitable adjustment is made or denied under another provision of this Contract.

VIII. CLAIMS.

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A. **CLAIMS FOR ADDITIONAL COST.**

If the Contractor wishes to make a claim for an increase in the Contract Sum or for extra costs or damages, the Contractor shall give the Owner written notice thereof within five (5) days after the event giving rise to such claim. Such claim will be submitted to the Superintendent of the Rockwall Independent School District, or designee, and that action shall be final and binding. Failure to give such notice shall be a waiver of the claim and such claim or possible claim shall be invalid and unenforceable unless so made.

B. **CLAIMS FOR ADDITIONAL TIME.**

1. If the Contractor wishes to make claim to change the date of Final Completion to allow for additional time, the Contractor shall give the Owner written notice thereof within five (5) days following the beginning of any such delay. In the case of a continuing delay only one claim is necessary. Such claim will be submitted to the Superintendent of the Rockwall Independent School District, or designee, and reviewed and approved or denied. Failure by Contractor to give such notice shall be a waiver of the claim and such claim or possible claim shall be invalid and unenforceable unless so made.

2. If adverse weather conditions are the basis for a claim for additional time, such claim shall be accompanied by Weather Bureau documentary evidence showing by comparison that such weather is abnormal to each of the past five (5) years. The guide for average climatological conditions will be the bulletin "Summary of Monthly Normals," for DFW Airport published by the Department of Commerce in cooperation with the National Oceanic & Atmospheric Administration.

IX. MISCELLANEOUS.

A. **AUTHORITY OF BOARD.**

The Owner is the Rockwall Independent School District, as identified in the Contract Documents. The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to enter into or amend a contract, to approve changes in the scope of Work, to approve and execute a Change Order or Construction Change Directive modifying the Contract Sum or Guaranteed Maximum Price, or agree to an extension to the date of Substantial or Final Completion. The Board will act as soon as reasonably possible to avoid undue delays. The Board designates authorized representatives to act on its behalf for day-to-day operations under the Contract. Unless otherwise designated in the Contract Documents, Owner's authorized representative shall be the Superintendent of Schools, who may delegate responsibilities as appropriate. Owner's Board of Trustees hereby delegates to the Superintendent of Schools or designee(s) the authority to approve changes to the Work where such changes are within the Owner's Contingency not to exceed $35,000.00, or will not increase the dates for Substantial or Final Completion by more than zero days. Any such change shall be confirmed in writing between the Contractor and Owner's Superintendent or designee(s), and notice of such approved changes shall be given to the Board at its next regular meeting; except as

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otherwise provided in the Contract Documents, the Architect or Owner's Consultant does not have such authority. Neither Architect or Owner's Consultant nor Contractor may rely upon the direction of any employee of Owner who has not been designated in writing by the Superintendent or Board of Trustees; Owner shall not be financially responsible for actions taken by the Architect or Owner's Consultant or Contractor in reliance upon direction from unauthorized persons.

B. **HAZARDOUS MATERIALS.**

IF HAZARDOUS MATERIALS ARE ENCOUNTERED AS A RESULT OF CONTRACTOR OR ITS SUBCONTRACTORS' IMPORTATION OF SUCH MATERIALS ONTO THE PROJECT SITE, THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD HARMLESS THE OWNER, ITS OFFICERS, DIRECTORS, AND EMPLOYEES FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, COSTS AND EXPENSES, INCLUDING BUT NOT LIMITED TO, ATTORNEYS' FEES, ARISING OUT OF OR RELATED TO THE IMPORTATION OF SUCH MATERIALS ONTO THE PROJECT SITE AND/OR CONSTRUCTION WORK IN ANY AREA AFFECTED BY HAZARDOUS MATERIALS.

If hazardous materials are encountered as a result of the Owner's failure to identify or remove hazardous materials prior to the commencement of construction, Owner agrees to (1) release the Contractor and its subcontractors, officers, directors, and employees from any and all claims, damages, losses, or expenses incurred by Owner arising out of or related to the performance of the Construction Work in the area affected by the hazardous material up to and including the time when Contractor first learns of or discovers the existence of the hazardous materials, but not for any additional work done by the Contractor after the identification of such hazardous materials; (2) release the Contractor from any indemnification obligations in this Agreement arising out of or related to the hazardous materials, except to the extent that any such claims, damages, losses, or expenses incurred by Owner arise from Contractor's actions or inaction after the initial discovery and identification of hazardous materials; and (3) extend the contract time by the actual number of days that Contractor is delayed in the completion of the contract arising out of or related to the identification, test, and/or abatement of the hazardous material if Contractor is unable to complete the Project by the scheduled completion date plus any agreed extension under other conditions of the Agreement.

C. **IMMIGRATION LAW.**

Contractor represents and warrants that all contractors and subcontractors working on this project for Owner will comply with all applicable federal and state immigration laws, and verify all employees' eligibility to work in this country. Further, Contractor shall ensure that all contractors and subcontractors will indemnify the Owner for any damages and legal fees that the Owner incurs as a result of Contractor's and/or any subcontractor's failure to comply with applicable immigration laws.

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D. **PREVAILING WAGE RATES.**

1. Contractor, Contractor's Subcontractors and Sub-subcontractors shall pay all workers not less than the general prevailing rate of per diem wages for work of a similar character where the Project is located, as detailed in the "Minimum Wage Schedule" provided herein. Wages listed are minimum rates only. However, no claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rate provided herein. Texas Government Code §2258, *et seq*.; Texas Labor Code §62.0512, *et seq*.

2. Contractor shall forfeit, as a penalty to the Owner, $60 for each laborer, worker or mechanic employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract Documents.

3. Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors.

4. In executing the Work under the Contract Documents, Contractor shall comply with all applicable state and federal laws, including but not limited to, laws concerned with labor, equal employment opportunity, safety and minimum wages.

5. If no "minimum wage schedule" is provided herein, the Contractor shall use the wage rates determined by the US Department of Labor in accordance with the Davis-Bacon Act, 40 USC Section 3141, which can be accessed on the internet at www.gpo.gov/davisbacon/, or determined by any local contractor association, whichever is less.

E. **TIME.**

1. Time limits stated in the Contract are of the essence. By executing the Agreement, the Contractor confirms that the date selected for Final Completion provides a reasonable period for performing the Project. Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Project is to be performed and correlated personal observations with requirements of the Contract.

2. The Contractor shall proceed expeditiously with adequate forces and shall achieve Final Completion by the date selected for Final Completion.

F. **GOVERNING LAW.**

This Contract shall be governed by the law of the State of Texas. Venue for any legal action arising out of the Project shall be in a state or federal court, as appropriate, in the county where the Owner's Administrative Offices are located.

G. **NO ASSIGNMENT.**

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Neither party to the Contract shall assign the Contract as a whole without written consent of the other.

H. **WRITTEN NOTICE.**

Written notice shall be deemed to have been duly served if delivered in person or if delivered at or sent by registered or certified mail to the following:

If to Owner:

Superintendent of Schools
Rockwall Independent School District
1050 Williams Street
Rockwall, Texas 75087

and to the Owner's authorized representative at the address set forth above.

David Carter, Senior Chief Financial Officer

If to Contractor:

(Insert Name and Address)

Contractor's authorized representative or, if a corporation, to an officer of the corporation at the address set forth above.

I. **RIGHTS AND REMEDIES.**

Duties and obligations imposed by the Contract and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

J. **ENTIRE AGREEMENT.**

This Agreement and the additional documents identified and referenced herein represent the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral.

K. **NO ISRAEL BOYCOTT.**

Pursuant to the requirements of Texas Government Code Chapter 2270, Contractor verifies that it does not boycott Israel, and it will not boycott Israel during the term of this Agreement.

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SAMPLE

This Agreement is entered into as of the day and year first written above and is executed in at least two original copies, one of which is to be delivered to the Contractor and one to the Owner.

OWNER:

_____
Signature

_____
Date

David Carter, CPA
Senior Chief Financial Officer

Rockwall Independent School District
1050 Williams Street
Rockwall, Texas 75087

CONTRACTOR:

_____
Signature

_____
Date

(Insert Name)
(Insert Title)

(Insert Company Name)
(Insert Company Address)
(Insert Contact Number)

SAMPLE

Contractor Certification

Introduction: Texas Education Code Chapter 22 requires service contractors to obtain criminal history record information regarding covered employees and to certify to Rockwall Independent School District (the "District") that they have done so. Covered employees with disqualifying convictions are prohibited from serving at a school district.

Definitions:

Covered employees: All employees of a contractor who have or will have continuing duties related to the service to be performed at the District and have or will have direct contact with students. The District will be the final arbiter of what constitutes direct contact with students.

Disqualifying conviction: One of the following offenses, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) an equivalent offense under federal law or the laws of another state.

On behalf of_____ ("Contractor"), I certify that [check one]:

[ ] None of Contractor's employees are *covered employees,* as defined above. Or

[ ] Some or all of Contractor's employee are *covered employees.* If this box is selected, I further certify that:

(1) Contractor has obtained all required criminal history record information, through the Texas Department of Public Safety, regarding its covered employees. None of the covered employees has a disqualifying conviction. Contractor has taken reasonable steps to ensure that its employees who are not covered employees do not have continuing duties related to the contract services or direct contact with students.

(2) If Contractor receives information that a covered employee has a disqualifying conviction, Contractor will immediately remove the covered employee from contract duties and notify the District in writing within 3 business days.

(3) Upon request. Contractor will make available for the District's inspection the criminal history record information of any covered employee. If the District objects to the assignment of a covered employee on the basis of the covered employee's criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at the District.

Noncompliance by Contractor with this certification may be grounds for contract termination.

_____
Signature

_____
Date

Exhibit "A"

SAMPLE