CONSTRUCTION DOCUMENTS

general construction volume

1

divisions 00 thru 20

Warehouse 649 Remodel

180 GARNET STREET I TOOELE, UTAH

OWNER

Tooele County School District
92 Lodestone Way I Tooele, Utah 84074

DATE

16 August 2021

PROJECT MANUAL

VCBO ARCHITECTURE
524 South 600 East | Salt Lake City, UT 84102 | 801.575.8800 t | 801.531.9850 f | vcbo.com

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Not Used

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DIVISION 22 PLUMBING

DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 25 INTEGRATED AUTOMATION

DIVISION 26 ELECTRICAL

DIVISION 27 COMMUNICATIONS

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NOTICE TO CONTRACTORS

Tooele County School District – 649 Remodel
180 Garnet St. Tooele, UT 84074

Westland Construction, Inc., as Construction Manager for Tooele County School District, is requesting labor and material bids for the construction of the **Tooele County School District – 649 Remodel** in accordance with plans, specifications and bid documents as prepared by VCBO Architecture.

A pre-bid onsite meeting will be held August 24th at 10:00AM. This meeting is **not mandatory.**

Proposals will be received on or before **Thursday, September 2nd at 2:00PM** prevailing Mountain Time at the offices of Westland Construction, Inc. (Email & Fax Number listed below). **All proposals must be submitted on the provided Bid Form found in the project manual.**

Questions on scope of work, trade coordination and bidding should be directed to Jessica Dahl at Westland Construction and Mike Ririe at VCBO Architecture.

Westland Construction, Inc.	VCBO Architecture
1411 West 1250 South Suite 200	524 S. 600 E. Salt Lake City, UT 84102
Phone: 801-374-6085	Phone: 801-575-8800
Fax: 801-374-6060	Fax:
jessica@westlandconstruction.com	mririe@vcbo.com
www.westlandconstruction.com	www.vcbo.com

A 5% BID SECURITY MUST BE ATTACHED FOR BIDS OVER $100,000. PLEASE SUBMIT COPY OF BID SECURITY VIA FAX OR EMAIL. Bid Security may be a bid bond made payable to the order of Westland Construction, Inc. The bid security of the accepted bidder shall be forfeited in the case of failure or refusal to enter into a contract and furnish payment and performance bonds as may be required.

Time is of the essence on this project. Refer to the Bid Documents for specific schedule and liquidated damage requirements.

Inasmuch as the Owner is a political subdivision of the State of Utah, all trades on the project must certify by affidavit, prior to commencing any work on the project, that they participate in a **Status Verification System** to verify the work eligibility status of its new employees in accordance with Section 63G-11-103 Utah Code Annotated.

Any award or rejection, in whole or in part, relating to this project is contingent upon budget restraints. Refer to the Bid Documents for Proposal Guidelines.

The Owner and Construction Manager reserve the right to accept or reject any and all proposals or alternates with or without cause for any reason determined in its sole subjective determination to be in the Owner's best interest and to waive any informality in bidding.

Proposals shall be properly executed upon the Bid Form with all items filled out. The completed form shall be without deletions, alterations or erasures. Proposal forms are available at the office of the construction manager and in the specification manual.

Before submitting a proposal, bidders shall carefully examine the plans, read the project manual, all addenda and all other bid documents. They shall visit the site of work and shall fully inform themselves as to all existing conditions and limitations. They shall include in the proposal a sum to cover the cost of all items included in the bid documents and within the time frame stated in the bid documents.

Securing Documents: Plans and project manual will be available to interested parties no earlier than Thursday, August 19th. Plans can be viewed online at www.westlandconstruction.com. Contact Jessica Dahl @ 801-374-6085 or Jessica@westlandconstruction.com to make arrangements to receive bidding documents.

Contractor's Qualification Statement: Any bidder shall, upon request, submit a Contractor's Qualification Statement, AIA Document A305. Failure to show a statement satisfactory to the Owner will be reason to reject the proposal as non-responsive.

BID FORM
TOOELE COUNTY SCHOOL DISTRICT – 649 REMODEL
180 GARNER ST. TOOELE, UT 84074

Name of Bidder:_____ Date: _____
Address:_____ City/Zip:_____
Contact Person:_____ Email:_____
Phone:_____ Fax:_____

Bid to: Westland Construction, Inc.
1411 West 1250 South, Ste 200
Orem, UT 84058
Telephone: (801) 374-6085 Fax: (801) 374-6060
Email bids to bids@westlandconstruction.com

Addenda: I/We acknowledge receipt of the following addenda:**__/__/__/__/.**

THIS PUBLIC SCHOOL PROJECT IS SALES TAX EXEMPT; DO NOT INCLUDE SALES TAX IN YOUR BID!
Note: All materials purchased for this project are tax exempt and subject to Form TC-721 Exemption Certificate, to be filed with each vendor.

Specification Sections Bidding**:**

Division / Section(s) & Description	Installed?	Bid Amount
_____	_____	$_____
_____	_____	$_____
_____	_____	$_____

Base Bid:_____

Dollars ($_____)
(In the case of discrepancy, written amount shall govern)

LINE ITEM COSTS: Please separate the following items:
Line item costs are to be INCLUDED in the base bid amount
(You may also include this information on a separate attached document)

MILLWORK SUBCONTRACTORS (064023):

Cubbies separate from General Millwork $_____

MECHANICAL SUBCONTRACTORS (Div. 22 & Div. 23):

Test & Balance: Subcontractor:_____ $_____

Sheet Metal: Subcontractor:_____ $_____

Controls: Subcontractor:_____ $_____

ELECTRICAL SUBCONTRACTORS (Div. 25- Div. 28):

271005 – Structured Cabling
Subcontractor:_____ $_____

281300 – Access Control
Subcontractor:_____ $_____

275124 – Intercom System
Subcontractor:_____ $_____

265561 – Theatrical Lighting & Dimming System
Subcontractor:_____ $_____

Proposed Project Foreman/Salesman:_____

Contact Phone: _____ **Contact Email**:_____

B. ADDITIONAL BIDDING REQUIREMENTS: (**Failure to respond where required may result in disqualification of the bid).**

1. Bids shall be priced lump sum to furnish and/or install all material and/or equipment as required by plans and specifications. A 5% BID SECURITY MUST BE ATTACHED FOR BIDS OVER $100,000. **PLEASE SUBMIT COPY OF BID SECURITY VIA FAX OR EMAIL.** Bid Security may be a bid bond made payable to the order of Westland Construction, Inc. The bid security of the accepted bidder shall be forfeited in the case of failure or refusal to enter into a contract and furnish payment and performance bonds as may be required.

2. Westland Construction, as Construction Manager for Tooele County School District reserves the right to accept or reject any and all proposals or alternates with or without cause for any reason determined by it or the District to be in the District's best interest and to waive any bidding informality.

3. Liquidated Damages for the project will be the following:

Days of Delay	Liquidated Damages per Day
0 to 15	$500.00
15 to 30	$1,000.00
30 to 45	$1,500.00
45 or more	$3,000.00

4. The undersigned, having examined the Drawings, Specifications and related documents in their entirety, and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of labor, hereby propose to complete the work listed above in accordance with the Contract Documents and within the time set forth, at the price stated above and upon the subcontract form included in the Bid Documents. The above price is to cover

all expenses incurred in performing the work required under the Contract Documents of which this proposal is a part.

5. CONTRACTOR'S QUALIFICATION STATEMENT: Upon request the low bidders shall submit a Contractor's Qualification Statement, A.I.A. document A305. Failure to show a statement satisfactory to the Owner or Construction Manager will be reason to reject the bid as nonresponsive. Past performance on similar projects and your ability to perform the work on this project to the satisfaction of the Owner and Construction Manager and perform the work on schedule will be a priority in awarding a subcontract.

6. **Past Relative Experience**: List projects of similar size and scope of work. This information may also be attached to this proposal.

Project Name	Contract Amount	Completion Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

References:

Company	Contact	Phone/Email
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. **COST FOR PAYMENT AND PERFORMANCE BOND:** **$**_____

Price NOT to be included in Base Bid

(If no amount is provided, it will be presumed that the subcontractor is unable to provide a bond for its work on this project).

Surety Company: _____ (Insurance Company)

Surety Agent: _____

Contact Information (Name & Phone Number): _____

THE BID DOCUMENTS ARE A COMPLETE PACKAGE. SUBCONTRACTORS BIDDING INDIVIDUAL SECTION(s) OR ANY PART THERE OF SHALL REVIEW ALL BID DOCUMENTS TO DETERMINE THEIR TOTAL SCOPE OF WORK AND INCLUDE ALL RELATED COSTS.

_____

Name of Bidder

_____ Date _____

Authorized Signature

List all second-tier subcontractors, if any, you will contract with to complete the work if you are awarded the subcontract.

_____

_____

Value Engineering – (Optional) Include a description of each of your value engineering proposals and the cost impact that each would have on your bid listed above:

WESTLAND CONSTRUCTION, INC.
1411 West 1250 South, Suite 200
Orem, UT 84058
Phone: (801) 374-6085 Fax: (801) 374-6060

SUBCONTRACT AGREEMENT

This Subcontract is entered into, effective as of **DATE**, by and between **WESTLAND CONSTRUCTION, INC.**, 1411 West 1250 South, Suite 200, Orem, Utah 84058 (hereinafter "Contractor") and the Subcontractor more particularly identified as:

SUBCONTRACTOR: **SUBCONTRACTOR LEGAL NAME**
ADDRESS
CITY, STATE, ZIP
Contact: CONTACT
Phone: ###-###-####
Cell: ###-###-####
Fax: ###-###-####
Email:

LICENSE #: _____.
STATE:

PROJECT: **Tooele County School District – 649 Remodel**

OWNER: **Tooele County School District**

ARCHITECT: **VCBO Architecture**

Contractor and Subcontractor, for good and valuable consideration, agree as set forth below:

A. **SUBCONTRACT DOCUMENTS**: The Subcontract includes and incorporates by reference the Terms and Conditions attached hereto which include and incorporate by reference many other documents.

B. **SCOPE OF WORK**: Subcontractor shall supply and pay for all labor, material and services necessary to perform all of the work outlined below. The following is a general description of the work to be performed and completed by the Subcontractor, including all work and material as specified in noted section(s) and/or division(s): In Construction of the **PROJECT NAME,** per the drawings, contract documents and specifications prepared by XXXX ***Architects. dated #/#/2019*** including addendum No. 1 dated ##/##/#### for the following scope of work:

SUPPLY AND INSTALL COMPLETE, AS PER DRAWINGS AND SPECIFICATIONS

<INSERT SCOPE OF WORK & SUMMARY DESCRIPTION HERE>
All sections, as they pertain to the performance of this subcontract.

DELETE IF NOT TAX EXEMPT →This project is tax exempt. Contract excludes sales tax on permanent materials in place.

Subcontractor will comply with all requirements as set forth in the project specifications including all plans and requirements as set forth in this Subcontractor Agreement. In addition, Subcontractor will require all lower tier subcontractors and suppliers to be bound by these same contract terms and conditions.

C. **CONTRACT AMOUNT**: WRITTEN AMOUNT Dollars and no/100 **($/total)**

D. **PAYMENTS**: Applications for monthly progress payments shall be in writing, on approved forms of Contractor, with cost breakdown. In addition, an unconditional lien waiver for subcontractor's suppliers and/or sub-subcontractors for the previous month payment must be submitted with pay request to the Contractor on or before the 25th day of each month. Subcontractor's payment application submitted on or

before the 25th of the month will be for work completed and work estimated to be completed through the end of the month. Contractor will issue payment to Subcontractor, by U.S. Mail only, within ten days of receiving payment from Owner.

E. **RETAINAGE: 5%** of Subcontractor's approved monthly billing will be held as retention until the work is accepted by Contractor and the Owner and until Contractor has received the retainage payment from the Owner. Subcontractor must submit a separate retainage invoice to receive payment of retention.

F. **SUBMITTALS**: **1 electronic copy (preferred) emailed to (Projectengineer)@westlandconstruction.com** as soon as possible, no later than DATE. Contractor and Architect's review of the Submittals will be for the limited purpose of checking for general conformance with the Contract Documents and will not be conducted for the purpose of determining the accuracy and completeness of details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Subcontractor. Contractor and Architect's review of Submittals will not relieve Subcontractor of its obligations under the Contract Documents. Contractor and Architect's review of Submittals will not constitute acceptance of safety precautions or construction means, methods, techniques, sequences or procedures. Contractor and Architect's acceptance of a specific item will not indicate acceptance of an assembly of which the item is a component.

G. **ATTACHMENTS**: The attachments A, B, C, D, E, F and G referenced hereto are incorporated herein.
Attachment A: (attached to back of Subcontract Agreement)
Attachment B: Subcontractor Disclosure Statement
Attachment C: Subcontractor's Certificate and Request for Payment and Conditional Waiver and Release
Attachment D: Conditional Waiver and Release Upon Progress Payment
Attachment E: Unconditional Waiver and Release Upon Progress Payment
Attachment F: Certification of Legal Work Status
Attachment G: Drawing Schedule

TERMS AND CONDITIONS OF SUBCONTRACT AGREEMENT

1. GENERAL PROVISIONS:

1.1 **Subcontract Documents**. The Subcontract Documents include: (1) this agreement, (2) any attached exhibits, (3) the prime contract between the Owner and Contractor including the General, Supplementary and other conditions of the prime contract, (4) the drawings and specifications, including all addenda issued prior to and all modifications issued after execution of the prime contract between the Owner and Contractor, (5) the project schedule, (6) all change authorizations or modifications to this agreement issued by the Contractor, (7) other documents listed herein or in the prime contract. These form the Subcontract Documents and are as fully a part of this Subcontract as if attached or repeated herein. Contractor and Subcontractor are hereby strictly bound to each other by the terms and requirements of the Subcontract. This Subcontract shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Contractor and Subcontractor.

1.2 **Scope of Work**. The work to be performed by the Subcontractor includes that work specifically set forth in this Subcontract, as well as any and all other work incident or related thereto, including, but not limited to, that work reasonably necessary for a complete and proper Project, or which is necessary to have a properly working and totally acceptable system and Project. All work covered by this Subcontract shall be performed in a skillful and workmanlike manner with material, equipment, etc. being both new and of the best kind and grade for the purpose intended. It being the express intent of the parties hereto that all work usually performed by the trades covered by this Subcontract and required by the Prime Contract shall be performed by the Subcontractor, in addition to that work specifically set forth herein.

The Subcontractor shall provide, at its own expense, all temporary and permanent tools, scaffolding, hoisting facilities, elevator service, implements, storage space, shop and working drawings, test, samples, models, guarantees, permits (excluding building permits), licenses, unloading facilities and services, and all other items necessary for the proper performance of this Subcontract and acceptance of the Project. The

Subcontractor shall pay for all inspection fees that are related to re-inspection of defective work, royalties, and license fees. The Subcontractor agrees to assume full responsibility for the accuracy of all lines, levels and measurements and their relation to bench marks, property lines, reference lines and the work of Contractor or other Subcontractors. Subcontractor is responsible for all lay-out, chalk-lines, survey, and work related to establishing necessary lines and grades. In all cases where dimensions are governed by conditions already established, the responsibility for correct knowledge of such conditions shall rest entirely on Subcontractor. No variation from specified lines or grades or dimensions shall be made except on the written authority of Contractor.

1.3 **Clean-up**. Subcontractor is responsible for clean-up of its work and/or payment of Subcontractor's prorate share of labor and facilities required for job clean-up, including regular and prompt removal and off-site disposal of all debris and rubbish occasioned by its work. To the extent any snow or ice needs to be removed for Subcontractor to perform its work, it shall be removed by Subcontractor at its sole expense. If Subcontractor elects to use dumpster provided by Contractor, Subcontractor agrees to pay its proportioned share of costs as determined by the Project Superintendent.

1.4 **Contractor Furnished Items**. Contractor shall furnish the following facilities at no cost to Subcontractor: (1) power – at least one location on site; (2) water – at least one location on site; (3) sanitary facilities.

2. PERFORMANCE OF WORK:

2.1 **Commencement of Work**. If Subcontractor has received its copy of this Subcontract for signature and commences work on site prior to signing this Subcontract, Subcontractor's commencement of work shall be deemed to be acceptance by Subcontractor of this Subcontract in its entirety. By signing this Subcontract or commencing work, **Subcontractor represents that it has visited and inspected the nature, locality and site of the work and the conditions and difficulties under which the work is to be performed, and that it enters into this Subcontract on the basis of its own examination, investigation and evaluation of all such matters and not in reliance upon any opinions or representations of Contractor, or Owner, or of any of their respective officers, agents, or employees. Subcontractor further represents that it has carefully reviewed and understands the Subcontract Documents** and is thus aware of any impact, relationship, or interference which the site, site conditions, climate, construction sequence, Subcontract Documents, and/or the work of other subcontractors or contractors will have upon Subcontractor's access, operations, efficiency, etc. Subcontractor further represents that it has reviewed and agrees to the schedule of Contractor.

2.2 **Timely Performance**. **Time is of the essence of this Subcontract**. Subcontractor therefore agrees: (1) to procure and prepare its materials so as to be ready to begin work when directed by Contractor, (2) to plan, prosecute, and complete its work in a prompt and diligent manner so as not to delay, disrupt, hinder or interfere with the work of Contractor or other subcontractors, (3) to commence the several parts thereof at such times and proceed therewith in such order as may be directed by Contractor (4) to provide, at its expense, additional workers and/or to work on an overtime or shift basis should Contractor reasonably so direct, (5) to do all layout, cutting, fitting and patching of its work as may be required to make its several parts come together properly and to fit it to receive or be received by the work of Contractor or other subcontractors, all as shown upon or reasonably implied by the Subcontract Documents, (6) to proceed in a skillful and expeditious manner, with sufficient labor, materials, tools, equipment, and supplies, (7) to complete the several parts and the whole of said work as provided herein so that, in conjunction with other subcontractors engaged thereon, Subcontractor will ensure the uninterrupted progress of the project and enable Contractor to complete the project as scheduled by Contractor.

2.3 **Schedules**. For purposes of scheduling the work, Contractor may periodically develop and modify project schedule(s). The Subcontractor agrees to furnish to Contractor any information necessary for Contractor to prepare its schedule(s). The float on the project schedules belongs to Contractor for us in scheduling the work. Contractor retains the right to modify, suspend, delay or accelerate, in whole or in part, said schedule(s), change work sequences and priorities, and to otherwise schedule the work so as to achieve timely project completion. So long as such modifications, changes in sequence, etc., are not arbitrary and capricious, Subcontractor agrees to adapt its efforts and to meet Contractor's schedule(s) as modified without additional cost to Contractor and/or Owner.

2.4 **No Damage For Delay**. Should Subcontractor's performance be delayed, hindered, interfered with, or otherwise disrupted by any act of Contractor, owner, other subcontractor or supplier, whether avoidable or unavoidable, reasonable or unreasonable, or foreseeable or unforeseeable Subcontractor's sole and exclusive remedy shall be an equitable time extension for the performance of the work, but only if Subcontractor shall have notified, in writing, Contractor of the cause of delay within seven (7) days of the occurrence of the event, and, provided a similar time extension of time is allotted to the Contractor by the owner. Subcontractor shall not be entitled to and hereby expressly waives any claim for any increase in the subcontract price or for additional damages or compensation as a consequence of such delays, unless the owner is liable and pays for such delays.

2.5 **Failure to Perform the Work**. If Subcontractor shall at any time: (1) refuse or neglect to supply a sufficient number of properly skilled workers or sufficient materials of the proper quality, or (2) fail in any respect to prosecute the work promptly, or (3) fail promptly to remove and replace work condemned by Owner, Architect or Contractor and make good work of others damaged by said replacement, or (4) cause by any action or omission the stoppage of, delay of or interference with the work of Contractor or of any other subcontractor, or (5) fail in the performance of any of the material covenants herein contained, or (6) be adjudged as bankrupt or make a general assignment for the benefit of creditors, or (7) become insolvent or a debtor in reorganization, receivership, composition or arrangement proceedings, then forty eight (48) hours after delivery of a written notice to Subcontractor indicating the existence of any of the foregoing causes, and unless the cause specified in such notice is eliminated within such forty eight (48) hours, Contractor at its option may provide, either by itself or through others, labor and materials to prosecute and complete the work and shall deduct the cost thereof from any amounts then due or thereafter to become due to Subcontractor. In any such event, after such notice and Subcontractor's failure to eliminate such cause within the forty eight (48) hours specified, Contractor may at its option (and without prejudice to any other remedy Contractor may have) terminate all or part of this Subcontract "for cause" and, for the purpose of completing the work, take possession of all or part of the materials and equipment of Subcontractor at the project site, all of which Subcontractor hereby assigns to Contractor. Contractor may then complete the work by whatever reasonable method Contractor deems expedient. In case of such partial or total termination the Subcontractor shall not be entitled to receive any further payment until the work required by this Subcontract is fully complete and accepted by Owner and Architect; and at such time, if the unpaid balance of the amount to be paid hereunder exceeds Contractor's costs, such excess shall be paid by Contractor to Subcontractor; but if Contractor's cost exceeds the unpaid balance, Subcontractor shall promptly pay the difference to Contractor. "Costs", as used in this Paragraph, shall include: (1) Contractor's expenses incurred in taking over and completing Subcontractor's work, (2) damages incurred by Contractor due to Subcontractor's non-performance, etc., and (3) 15% for Contractor's overhead and profit.

2.6 **Damages**. If Subcontractor fails to prosecute the work as required in this Subcontract, Subcontractor and its surety, when applicable, shall be liable for both: (1) liquidated damages, if any, assessed against Contractor by Owner related in whole or in part to Subcontractor's (or any other person or entity for whose acts Subcontractor may be liable) non-performance, and (2) actual damages incurred by Contractor and it subcontractors and suppliers caused or contributed to by delay caused by Subcontractor's responsibility for such damages shall exist regardless of whether Contractor elects to take over Subcontractor's work. In the event liquidated damages or actual damages, or both, are caused by Subcontractor and another entity, Contractor shall have the right to reasonably apportion said damages between the parties, and such apportionment shall be binding on Subcontractor. Contractor and Subcontractor shall not be liable to one another for any delays arising out of acts of God.

2.7 **Other Subcontractors**. Contractor shall not be liable to Subcontractor for any damages, loss or expense resulting from acts of omissions (whether or not negligent), failure to perform, delays in performance, or defaults of a supplier or another subcontractor in connection with the performance of any of the work covered by the Prime Contract and/or this Subcontract. Subcontractor agrees that any project supplier or other subcontractor shall have a direct right of action against Subcontractor for damages, loss or expense resulting from Subcontractor's acts or omissions (whether or not negligent), failure to perform, delays in performance, or default.

2.8 **Safety**. At all times while any of Subcontractor's employees, agents, or subcontractors are on the Owner's premises, Subcontractor shall be solely responsible for providing them with a safe work place of employment, and Subcontractor shall inspect the places where its employees, agents or subcontractors are or may be present on Owner's premises and shall promptly take action to correct conditions which are or may become an unsafe place of employment for them. Subcontractor, its agents, employees, materialmen and subcontractors shall perform its work in a safe manner, including, but not limited to: (1) to comply with all safety regulations, including the applicable Occupational Safety & Health Act and all regulations adopted there under, (2) to provide safe tools and equipment, (3) to hold weekly safety meetings, (4) to install barricades, signs, flags, lights and other safe guards to prevent injury to workers and others on or about the construction site, (5) to provide superintendent with a copy of Material Safety Data Sheets (MSDS) for each chemical or hazardous material subcontractor has delivered to the project, (6) to make certain that hazardous material containers are properly labeled and that all of subcontractors employees have been properly trained on the care, handling, and use of the hazardous materials, (7) that the workers job attire, at a minimum, shall include long or short sleeve shirts, long pants, leather shoes or boots, safety glasses and hard hats and such other appropriate safety equipment, and (8) to have its employees and subcontractors conform to Contractor's drug free work place policy which shall be displayed on the job site, (9) provide contractor a copy of subcontractor's written safety program. Subcontractor shall indemnify and save harmless Contractor and Owner, and their officers, employees and agents, from any and all claim, loss or liability, including attorney's fees, arising out of Subcontractor's failure to comply with this provision.

The person in subcontractor's organization responsible for safety:

Name: _____

Cell # _____

2.9 **E.E.O./Affirmative Action**. Subcontractor shall fully comply with wage-hour regulations and shall take vigorous affirmative action to comply with E.E.O. and Affirmative Action Clauses as required by Executive Order 11246, 41 CFR 60-1.4, 41 CFR 60-1.7(b), 41 CFR 60-250.4, 4.1 CFR 60-741.1, 41 CFR 300.44(f)(1)(ii), CFR 60-741.44(f)(1)(ii) and the related regulation of Secretary of Labor, 41 CFR, Chapter 60 as revised, amended or suspended whenever lawfully required and is encouraged to do so in the absence of such requirement.

2.10 **Fines**. Subcontractor to indemnify Contractor against any and all fines, costs, and expense incurred by Contractor as a result of Subcontractor's failure to comply with any law, regulation or directive by any and all government entities. If Subcontractor's alleged acts or omissions result in a fine or penalty being levied against Contractor by OSHA or any other lawful regulatory agency or court, then the amount so levied shall be for Subcontractor's account and shall be deducted from amounts otherwise due Subcontractor. If the amount of fines exceeds the amount of Subcontractor funds that are available for offset, then Subcontractor will within 10 days reimburse to the Contractor the amount of deficiency.

2.11 **Supervision**. Subcontractor shall provide competent and continuous supervision of its work. Instructions given by Contractor to Subcontractor's superintendent or foreman and documents executed by said superintendent or foreman shall be binding upon Subcontractor.

2.12 **Acceptance of work**. All work shall be done, in strict accord with the prime contract, subject to the final approval of the Contractor, Owner, and Architect. The Architect's decision in matters relating to artistic effect shall be final.

2.13 **Acceptance of the Work of Others**. Should the proper performance of any work under this Subcontract depend upon the proper performance of any work or material furnished by contractor or others, Subcontractor agrees to use all reasonable means necessary to discover any defects and report them in writing to Contractor before proceeding with its work. Subcontractor shall allow Contractor a reasonable time in which to remedy such defects. In the event Subcontractor does not so report any defects to Contractor in writing, then it shall be presumed that Subcontractor has fully accepted the work of others as being satisfactory. Subcontractor shall be fully responsible thereafter for satisfactory performance of the work covered by this Subcontract, regardless of the defective work of others. Contractor disclaims

responsibility for data, documents, drawings or information of any nature whatsoever provided by Owner or Architect. The accuracy of such information is not warranted, and it is the Subcontractors responsibility to verify its accuracy.

2.14 **Incidental Charges**. Unless otherwise noted in this Subcontract, reasonable amounts for unloading, hoisting, clean-up, templates, layout or other services provided by Contractor for Subcontractor, and reasonable amounts for Contractor's equipment, tools, etc.., used by Subcontract shall be deducted from amounts otherwise due Subcontractor. Charges for incidental extra work performed by one party at the request of the other party, or for the benefit of the other party, or in the event of default by the other party shall be charged at direct field cost plus a 15% charge for home office overhead and profit and shall be executed as a change order.

2.15 **Permits, Fees and Codes**. Subcontractor shall, at its own cost and expense pay all fees related to the execution of its work; apply for and obtain all necessary permits (Excluding building permits), licenses, etc.; and conform strictly to the laws, building codes and ordinances in force insofar as applicable to the work covered by this Subcontract.

2.16 **Independent Contractor**. Subcontractor represents and agrees that it is an independent contractor in fact and also within the scope of the United States Internal Revenue Code; Social Security, and unemployment insurance laws and regulations; applicable safety, health and environmental laws and regulation (e.g. OSHA, MSHA); and applicable collective bargaining agreements and is therefore solely responsible for: (1) its compliance with such laws, regulations and agreements, (2) all payroll taxes, and (3) all trust fund and other deductions, withholdings and contributions payable under such laws, regulations and agreements. The contract amount includes all applicable sales and use taxes; franchise, excise and other taxes; and governmental impositions of all kinds and is not subject to any addition for any such taxes or impositions now or hereafter levied.

2.17 **Guarantee/Warranty**. During the guarantee (or warranty) period(s) established in the Subcontract, and if no such period(s) be therein stipulated, then for a period of one (1) year from date of final completion of the total project, Subcontractor agrees to promptly make good, solely at its expense, any work performed by Subcontract contrary to the Subcontract (including all defects due to defective workmanship and/or materials) and all damage and other losses resulting therefrom. Subcontractor further agrees to provide, in writing, any guarantees, maintenance agreements or other documents related to the work above described required by the Subcontract. Subcontractor's responsibility for latent defects shall extend beyond the guarantee period to the maximum extent as applicable statutes permit.

3. CHANGE ORDERS/FIELD ORDERS:

Contractor may add to or deduct from the work required by this Subcontract and any changes so made shall be defined only by Contractor's written Change Order or by Contractor's written Field Order. Contractor's Project Manager is the only person authorized to sign for a Change Order or Field Order. Contractor's Superintendent is only authorized to sign off in verifying Subcontractor's resources, employees and hours worked, materials, and equipment when required. In no instance is Contractor's Superintendent authorized to approve the cost or change in the work of a Change Order or Field Order. A Change Order is executed before the performance of the work and sets forth the changes involved and the value and time impact thereof, which value and time impact shall be mutually agreed upon between Contractor and Subcontractor and Owner (if possible). A Field Order is a written order from Contractor to Subcontractor directing a change to the work and setting forth a proposed basis for adjusting the Subcontract price and time (if any). A Field Order is used in the absence of total agreement on the terms of a Change Order. A Field Order will be replaced by a Change Order after the price and time impacts have been agreed to. If mutual agreement is not possible, then the price and time impact shall be determined as provided in Article 7 of this Subcontract. In either event, Subcontractor agrees to proceed with the work as changed when so ordered in writing by Contractor so as not to delay the progress of the work and pending determination of the value thereof. No claim for additional compensation, whether on account of extra labor and/or materials furnished, changed conditions, or otherwise, shall be paid unless the same is furnished pursuant to a written Change Order or Field Order signed by Contractor. Subcontractor shall provide Contractor with detailed pricing and time extension information for a proposed change in the work within seven (7) days of receipt of information

regarding said proposed change. Subcontractor shall provide Contractor with detailed pricing and time extension information for alleged changed conditions within seven (7) days of encountering alleged changed conditions. **Subcontractor shall not be entitled to compensation or time extension for claimed changed conditions unless written claim for same is received by Contractor within seven (7) days.**

Subcontractor shall review each change order or request for change order or directive issued by the Owner, and advise Contractor, in writing, within 7 days of receipt, as to the impact, if any, on Subcontractor's work, including any adjustment in Subcontract time or price. Subcontractor shall proceed with the changed work as directed by Contractor while such claim for adjustment is being determined by this Subcontract.

4. **PAYMENTS:**

4.1 **Cost Breakdown**. Within twenty (20) days of the date of this Subcontract, Subcontractor shall submit for Contractor's review and approval a detailed true cost breakdown of the contract amount sufficiently itemized as to work elements, labor, equipment, materials, etc., to allow Contractor to monitor Subcontractor's progress and to evaluate Subcontractor's periodic billings. Subcontractor's overhead and profit shall be distributed on a prorated basis to each line item. An intentionally unbalanced distorted or misrepresented cost breakdown shall be deemed to be fraudulent.

4.2 **Billings/Payments**. Contractor shall make, on account of the Subcontract price (adjusted by approved Change Orders, if any), monthly payments to Subcontractor for that portion of the work satisfactory performed in the preceding month in accordance with monthly billings prepared by Subcontractor and as approved by Contractor, Architect/Engineer and Owner. Applications for monthly progress payments shall be in writing, on approved forms of Contractor, with cost breakdown. In addition, an unconditional lien waiver for subcontractor's suppliers and/or sub-subcontractors for the previous month payment must be submitted with pay request to the Contractor on or before the 25th day of each month. Contractor will release payment to Subcontractor within ten (10) days of receiving payment from Owner. In the event Contractor does not receive from Subcontractor a proper and reasonable monthly billing prior to the date set forth above, Contractor may include in its monthly billing to Owner such amount, if any, as Contractor shall deem proper for the work of Subcontractor, and Subcontractor agrees to accept the approved portion, if any, as its monthly payment. Subcontractor shall also submit Supplier Affidavits, on Contractor's forms, as a condition precedent to receiving payment from Contractor. Subcontractor agrees that Contractor has the right to communicate with any subcontractor or supplier of Subcontractor regarding the status of payment by Subcontractor.

As an absolute condition precedent to Subcontractor's entitlement to any payment under this Subcontract, Contractor shall have first received from the Owner (unless the Owner's failure to make payment shall have been caused exclusively by Contractor) the corresponding periodic payment including the approved portion of Subcontractor's monthly billing. The Subcontractor acknowledges that it relies on the financial ability of the Owner and not the Contractor for payment of the work.

4.3 **Payments by Subcontractor**. Subcontractor shall pay for materials, equipment, and labor used in connection with performance of this Subcontract through the period covered by previous payments received from Contractor, and shall furnish releases, and satisfactory evidence, when requested by Contractor, to verify compliance with these requirements. If payment for material stored off-site and not delivered to the site is requested and made, title to such material shall pass to Contractor but Subcontractor shall remain fully liable for all such material not delivered to the job site and shall be responsible for providing insurance for such stored material.

4.4 **Payments Withheld**. Payments otherwise due Subcontractor, including payment of retainage and final payment, may be withheld by Contract on account of: (1) failure of Guarantor(s) to sign the Guarantee Agreement, if required, (2) failure of Subcontractor to provide surety bonds, if required, (3) failure of Subcontractor to provide acceptable and current certificates of insurance, (4) failure of Subcontractor to provide an acceptable cost breakdown, (5) failure of Subcontractor to complete Contractor's Supplier Affidavit and monthly lien release forms, (6) failure to sign or resolve change order for current billing period, (7) defective work of Subcontractor not remedied, (8) failure of Subcontractor to make payments owing to its employees, suppliers, or subcontractors for material, services or labor, (9) claim(s) filed by or involving

Subcontractor or reasonable evidence indicating the probability of such a claim being filed, (10) failure of Subcontractor to perform per schedule or commitment made by Subcontractor according to this agreement, (11) failure of Subcontractor to perform per Contractor's schedule, or (12) a reasonable doubt that Subcontractor can complete the work of this Subcontract for the balance then unpaid.

4.5 **Right to Offset/Joint Checks**. Contractor may offset against any sums due Subcontractor hereunder the amount of any obligations of Subcontractor to Contractor whether or not arising out of this Subcontract. Whenever Contractor reasonably so elects, Contractor may issue joint checks to Subcontractor and its suppliers and subcontractors. Contractor's options, set out in this Paragraph, confer absolutely no enforceable rights upon any third party.

4.6 **No Implied Acceptance**. Payment to Subcontractor pursuant to monthly or final billings shall not constitute nor imply acceptance by Contractor, Architect or Owner any portion of Subcontractor's work.

4.7 **Liens**. Subcontractor shall complete Contractor's monthly lien release and supplier affidavit forms, and save and keep the project and improvements referred to in this Subcontract and the lands upon which they are situated free from all liens and encumbrances, including, but not limited to, mechanic's and materialmen's liens arising out of its work. If Subcontractor fails to remove any lien, by bonding or otherwise, Contractor may retain sufficient funds out of any amounts due or thereafter to become due by Contractor to Subcontractor to pay the same and all costs incurred by reason thereof, and may pay said lien or liens and costs out of any funds at any time in the hands of Contractor owing to Subcontractor.

4.8 **Final Payment and Retainage**. The retainage portion of Subcontractors' approved monthly billings, and any other portion of the contract amount which is unpaid at the time of project completion shall be retained by Contractor, and shall not be paid to Subcontractor until: (1) Contractor receives final project retainage payment from Owner, (2) Architect and Owner accepts Subcontractor's work, guarantees, etc., and (3) Subcontractor furnishes Contractor with satisfactory evidence that all obligations incurred by Subcontractor pursuant to this Subcontract have been paid in full. Subcontractor must submit an invoice for retainage to receive payment for retainage. Acceptance of final payment by Subcontractor shall constitute a waiver of any and all claims by Subcontractor against Contractor, Owner and Architect and Subcontractor agrees to hold the Contractor harmless from any and all claims the Subcontractor may have against the Contractor. Any payment, however, final or otherwise, shall not release the Subcontractor or its sureties from any obligations under this agreement.

5. **INSURANCE AND DUTY TO DEFEND, INDEMNIFY & HOLD HARMLESS**:

5.1 **Certificates of Insurance**. Prior to commencing its work on site and prior to receiving a payment otherwise due per this Subcontract, Subcontractor shall furnish and thereafter maintain certificates of insurance and indemnification satisfactory to Contractor evidencing compliance with the terms of this Subcontract. Said certificates of insurance and the policies represented thereby shall not be canceled or modified until thirty (30) days after written notice has been given to Contractor. Subcontractor's Insurance shall provide an endorsement affording (30) days' notice of cancellation to Contractor. Required coverage shall be maintained without interruption from the date Subcontractor commences work under this Subcontract through the Statute of Repose. By accepting certificates of insurance from Subcontractor, Contractor does not waive any terms or conditions outlined in this Agreement and this Agreement shall supersede any and all other agreements (as stated in Section 8.3).

5.2 **Worker's Compensation Insurance**. Subcontractor agrees to provide and maintain Worker's Compensation Insurance as required by statute, and Employer's Liability insurance with the following limits:

(a)	Bodily Injury by Accident	$100,000 each accident
(b)	Bodily Injury by Disease	$100,000 each employee
(c)	Bodily Injury by Disease	$500,000 policy limit

and to comply in all respects with the terms for employment and payment of labor required by Owner or any constituted authority having legal jurisdiction over the work. If for whatever reason, Subcontractor waives coverage under any applicable worker's compensation policy for any of its owners, then to the extent

permitted by law, Contractor shall not be liable for Subcontractor's claims, losses, damages, or expenses which would otherwise be payable under an applicable worker's compensation policy. Subcontractor shall use insurance companies licensed to do business in the state in which the Work is performed, and with an A.M. Best rating of not less than A-, size VII or better. Said rating shall be as published by A.M. Best Company at the time the Contract is executed.

5.3 **Liability Insurance**. Subcontractor shall maintain such Commercial General Liability insurance, including Automobile and blanket contractual liability as will protect Subcontractor from claims for damage because of bodily injury, including death, or damage because of injury to or loss, destruction, or loss of use of property which may arise from its operations under this Subcontract, whether such operations be by Subcontractor or its subcontractors or anyone directly or indirectly employed by either of them.

Subcontractor's liability insurance shall provide the greater of the minimum limits set forth in the General Contract or the following minimum limits of coverage:

(1) Commercial General Liability

(a) General Aggregate	$2,000,000
(b) Products – Completed Operations Aggregate	$2,000,000
Subject to a per project general aggregate provision applicable to the project.	
(c) Each Occurrence	$1,000,000
(d) Personal & Advertising Injury	$1,000,000

Subcontractor's general liability insurance shall include Contractor, Owner, and Architect as additional named insured for both ongoing operations and completed operations (ISO form CG2010 11/85 or its equivalent). Insurance shall be written on an occurrence basis equivalent to ISO Form CG 0001 10/01, rather than on a claims-made basis., and will be primary and non-contributory to any insurance of the additional insured.

(2) Comprehensive Automobile Liability (Combined Single Limit) $1,000,000
Covering owned, non-owned, and hired vehicles.

Subcontractor shall use insurance companies licensed to do business in the state in which the Work is performed, and with an A.M. Best rating of not less than A-, size VII or better. Said rating shall be as published by A.M. Best Company at the time the Contract is executed. All insurance policies shall include coverage for explosion, collapse, underground, property damage and work performed by Subcontractors. Equivalent insurance must be obtained from each sub-subcontractor and supplier. Otherwise their insurance must be included in Subcontractor's policy. The Subcontractor agrees to furnish evidence satisfactory to the Contractor of such insurance, including copies of the policies when requested to do so by the Contractor.

In the event of threatened cancellation for nonpayment of premium, Contractor may pay same for Subcontractor and deduct the said payment from the amount then or subsequently owing to Subcontractor hereunder.

Subcontractor and Contractor each waive any right or claim to be subrogated on payment of loss or otherwise to any claim against Owner or the other and further waive any right against Owner or the other for damages caused by fire or other perils to the extent covered by property insurance being maintained by Owner or Contractor pursuant to the Contract Documents.

5.4 **Builder's Risk Insurance**. Subcontractor shall satisfy itself as to the existence, coverage and deductibles of Builder's Risk, property and/or equipment insurance prior to commencement of its work on the project. Upon Subcontractor's written request, Contractor shall provide Subcontractor with a copy of the Certificate of Builder's Risk insurance policy and any other property or equipment insurance in force for the project if said insurance has been procured by Owner. Until final acceptance of the project by Owner, Subcontractor shall be responsible for (1) loss or damage to its stored and installed materials, and (2) its prorate share of any deductible amount associated with an otherwise insured loss. Subcontractor has the option to insure against the deductible.

5.5 **Professional Liability Insurance**. If Subcontractor or any of its Sub-subcontractors or agents will provide any design, engineering or other professional services under the Subcontract documents, Professional Liability insurance shall be provided covering Subcontractor and Sub-subcontractors, and their respective professionals, for liability for negligent acts, errors, or omissions, arising out of the performance of the Subcontractor Work. The policy shall contain a blanket endorsement for contractual liability and afford coverage on a claims made basis (specific to the Project only):

Minimum Limits: Deductible not to exceed $100,000 per claim

Combined Single Limit for Each Occurrence	$1,000,000
Annual Aggregate Limit	$2,000,000

All coverage shall be retroactive to the earlier of the date of the Subcontract or the commencement of any services furnished under the Subcontract and shall be maintained for a period of (3) three years after the date of final payment under the Subcontract. Retroactive date of such policy must be on or before the date Subcontractor or it's Sub-subcontractors began offering professional services.

5.6 **Aircraft Liability Insurance**. If Subcontractor or any of its Sub-subcontractors or agents will operate aircraft in their scope of Work, a policy of aircraft insurance shall be provided on a standard form providing coverage for bodily injury (including death) and property damage for aircraft applicable to all owned, non-owned, and hired aircraft.

Minimum Limits: Combined Single Limit Per Occurrence $5,000,000

5.7 **Duty to Indemnify, Defend and Hold Harmless**. To the fullest extent permitted by law, Subcontractor shall indemnify, defend, and hold harmless Contractor and Owner, and their agents and employees against all claims, demands, damages, liabilities expenses and reasonable attorney fees incurred by Contractor and/or Owner arising out of or in any way related to the performance (or failure to perform) Subcontractor's obligations under this agreement, or anyone directly or indirectly employed by Subcontractor or anyone for whose acts Subcontractor may be liable, but only to the extent caused in whole or in part by negligent acts or omissions of the Subcontractor, its employees or agents, regardless of whether or not such claim ,loss, damage or expense is caused in part by the acts of one of the parties indemnified hereunder. Subcontractor shall also require in its agreement with its second-tier subcontractors to indemnify Contractor as set forth in this clause.

The obligations for indemnification herein required are severable. The inapplicability of any portion of the obligations for indemnification hereunder due to statute, court decisions, or any other basis, shall not nullify, reduce, or limit other obligations set forth herein. The obligation for Subcontractor to indemnify and hold harmless Contractor against claims, damages, losses, and expenses, including, but not limited to, attorneys fees, arising out of or resulting from the performance of Subcontractor's work under this Subcontract, due solely to the negligent acts or omissions of Subcontractor, will be deemed a severable distinct obligation to the extent found liable.

If there are any claims to persons or property unsettled for when the work herein provided for is finished, final settlement between Contractor and Subcontractor shall be deferred until such claims are adjusted, or suitable special indemnity acceptable to the Contractor is provided by the Subcontractor.

5.8 **No Limitation on Liability**. In any claim against Contractor and/or Owner by an employee of Subcontractor, anyone directly or indirectly employed by Subcontractor, or anyone for whose acts Subcontractor may be liable, the indemnification, duty to defend and hold harmless obligations in this Subcontract shall not be limited: 1) by any limitation on the amount or type of damages, compensation or benefits payable by or for Subcontractor under worker's compensation, disability benefit or other employee benefit acts or regulations, or 2) to the policy limits of any insurance coverage which Subcontractor maintains or is required to maintain.

6. **SUSPENSION / TERMINATION**:

6.1 **Suspension**. Contractor may, for its convenience or by direction, suspend the work, either in whole or in part, at any time upon written notice to Subcontractor stating the nature, effective date and anticipated duration of such suspension, whereupon Subcontractor shall suspend its work to the extent specified and shall place no further orders or perform no other work except as permitted by Contractor's notice of

suspension. During the period of such suspension, Subcontractor shall protect and care for all work, materials and equipment at the project site or at storage areas under its responsibility. The Subcontract price shall be adjusted as provided in Article 3 if the cost of the work is increased or decreased by reason of such suspension. If additional time for completion of the work is required as a result of such suspension, Subcontractor shall submit a written request for additional time. **Failure to submit a timely written request for additional time due to such suspension shall result in no extension of time being granted.**

6.2 **Termination for Convenience**. Contractor reserves the right to suspend or terminate the contract at any time for its convenience. In the event the Contractor decides to terminate all or part of the Subcontractor's work prior to project completion, then an equitable settlement for work performed under this Subcontract will be negotiated. Subcontractor shall receive, as its entire compensation, its actual, necessary, and reasonable costs of performing the work to the date of termination, as determined by audit of Subcontractor's records, plus a reasonable markup for overhead and profit. Subcontractor shall make its records available at reasonable times and places for Contractor's audit. In the event no agreement can be reached the matter will be resolved according to Article 7 of the Subcontract. In no event shall Subcontractor be entitled to prospective profits on unperformed work.

6.3 **Termination for Cause**. See Paragraph 2.5. In the event any termination of Subcontractor for cause is later determined to have been improper, the termination shall be automatically converted to a termination for convenience and Subcontractor shall be limited in its recovery strictly to the compensation provided for in the Termination for Convenience clause.

7. **DISPUTES:**

7.1 **Scope of Prime Contract**. In the event of a dispute arising between Contractor and Subcontractor with respect to whether the Prime Contract, including drawings and specifications, requires Contractor (and thus, perhaps, Subcontractor) to furnish any material or perform any labor, the decision of Architect shall be conclusive and binding. Should there be no architect or engineer over the work, then the matter in question shall be determined as provided in Paragraph 7.2.

7.2 **Methods of Resolution**. It is the general intent of the parties that any unresolved dispute relating to this contract shall be settled first by negotiation. In the event the parties do not negotiate a settlement the parties agree to participate in a minimum of four (4) hours of mediation in accordance with the mediation procedures of the American Arbitration Association, the cost of which shall be shared equally between the parties. Such mediation shall be a condition precedent to initiating or continuing any arbitration or litigation.

In the event the dispute, claim or other matter in dispute arising out of or related to this Subcontract or the breach thereof, is not resolved by negotiation or mediation, it shall be decided in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association at the sole discretion of Contractor. If a demand for arbitration is filed by Subcontractor, Contractor will advise Subcontractor, in writing, within 30 days after receipt of the demand for arbitration if Contractor exercises the option to arbitrate or rejects arbitration; such election, once made, shall be binding. The filing of a demand for arbitration by Contractor shall be deemed an election to arbitrate and shall constitute the exercise of the option of Contractor to proceed with arbitration.

Contractor may join or consolidate arbitration with the Owner, Architect, any other subcontractor, or any other party having an interest in the proceeding whose presence is required if complete relief is to be accorded in the arbitration. The decision of the arbitrator(s) shall be final and binding and shall be rendered in writing and may be entered for enforcement in any court of competent jurisdiction. Subcontractor shall carry on the work and maintain its progress during any legal or arbitration proceedings. The article shall not be deemed a limitation of any rights or remedies, which the Subcontractor may have under any Federal or State Mechanics Lien Laws or under any applicable labor and material payment bonds.

7.3 **Recovery of Attorney Fees, Interest, Etc**. In the event it becomes necessary for either party to enforce the provision of this Subcontract or to obtain redress for the violation of any provision hereof, whether by arbitration, or otherwise, the prevailing party shall be entitled to recover from the other party all costs and expenses associated with such action, including statutory interest and reasonable attorney fees.

7.4 **Consequential Damages**. Under no circumstances shall the Contractor be liable to the Subcontractor for consequential damages including, but not limited to, loss of use or loss of profit irrespective of whether resulting from negligence.

8. **ADDITIONAL PROVISIONS:**

8.1 **Subletting, Assignment, Etc**. **Subcontractor agrees not to transfer or sublet this Subcontract or any part thereof without the prior written consent of Contractor**. Subcontractor's rights to monies due hereunder are non-assignable except with the written consent of Contractor. Any assignment of monies due hereunder made without such consent is void.

8.2 **Owner Approval, Contact, Etc**. This Subcontract is subject to approval of Subcontractor by Architect and/or Owner. This Subcontract shall not become binding upon the parties hereto until the Prime Contract is executed by the parties thereto and approval for Contractor to proceed under the Prime Contract has been given by Owner or its representative.

8.3 **Sole and Entire Subcontract**. **This Subcontract is the sole agreement between the parties**. All verbal or written terms, conditions, proposals, opinions, representations, negotiations, and agreements made prior to the date of this Subcontract has, where appropriate, been made part of this Subcontract. It shall be binding upon the heirs, administrators, executors, successors, and assignees of the parties hereto. Except as specifically prescribed herein, this Subcontract shall not create any rights of or confer benefits upon, third parties. **No modification or change of the terms of this Subcontract shall be binding on Contractor unless approved in writing by an authorized officer or the designated Project Manager of the Contractor**.

8.4 **Notice**. Any notice, required to be given, to a party hereto shall be directed to such party and mailed by certified mail, personally delivered to an agent of the Contractor/Subcontractor, sent via electronic facsimile machine (fax), or via e-mail. Unless otherwise noted in this agreement, such notice shall be effective at the time received at the address indicated herein of such party. If noticed by facsimile or e-mail the notice shall be effective on the date sent unless sent after 5:00 pm. If sent after 5:00 pm then the notice becomes effective on the next day.

8.5 **Days**. All references to day or days shall mean calendar days.

8.6 **Non Enforcement Not a Waiver**. Failure on the part of either party to exercise its rights under the provision of this Subcontract for any breach of the provisions hereof by the other shall not constitute a waiver of such rights for any subsequent breach of any provision hereof.

8.7 **Severability**. Any provision of this Subcontract determined to be in violation of any law applicable thereto shall be void but that shall not affect the validity and enforceability of all other provisions hereof.

8.8 **Governing Law/Jurisdiction**. This Subcontract shall be deemed to have been made in and shall be interpreted under the laws in the jurisdiction in which the project is located.

8.9 **E-Verify**. Subcontractor shall certify to the Contractor by affidavit that the Subcontractor has verified through the Status Verification System (E-verify) the employment status of each new employee of Subcontractor, all in accordance with Section Utah Code Ann. Section 63G-11-103 and shall comply with all applicable employee status verification laws. Such affidavit must be provided prior to the notice to proceed for the Subcontractor to perform any portion of the work.
Subcontractor will require that the above stated provisions be placed in each subcontract at every tier. Subcontractor is responsible for providing to Contractor Certification by Affidavit by its lower tiered contractors verifying the use of the Status Verification System (E-verify).
Subcontractor shall protect, indemnify and hold harmless the Contractor and its officers, employees, agents, representatives and anyone that Contractor may be liable for, against any claim, damages or liability arising out of or resulting from the violation of this Section 8.9 whether violated by employees, agents or contractors

of (a) the Subcontractor, (b) Subcontractor's Sub-Subcontractor at any tier; and/or (c) any entity or persons from whom the Subcontractor may be liable.

See Attachment "F" – Certification of Legal Work Status

Contractor and Subcontractor acknowledge receipt of pages 1 through 15 of this document.

SUBCONTRACTOR LEGAL NAME	**WESTLAND CONSTRUCTION, INC.**
By: _____	By: _____.
Signature Date	Signature Date
_____	_____ Project Manager.
Printed Name & Title	Printed Name & Title

Attachment A

W#PROJECT NAME

As a subcontractor on the above listed project, I agree to comply with the following items in order to help the project run in a more timely and efficient manner.

- I agree to meet or complete our work sooner than the scheduled time that has been presented by Westland Construction on their schedule.
- I agree to have all employees wear hard hats while working on the project site.
- I agree to attend all job site coordination and safety meetings that are requested by Westland Construction's superintendent.
- I agree to have all monthly pay requests in to Westland Construction's Orem office **no later than the 25th** of the month.
- I agree to have all closeout documents and warranties in to Westland Construction's Orem office 30 days prior to final closeout of the project.

PURCHASE ORDER

JOB NAME: Tooele County School District – 649 Remodel **WESTLAND JOB #** W###

DATE: 2021 **DELIVERY ADDRESS:** 180 Garner St. Tooele, UT 84074

DELIVERY DATE: _____ **F.O.B:**_____

SELLER: _____

A: In strict accordance with drawings and specifications, including all general and supplementary conditions and attachments, we authorize you to supply the items listed below in the Scope of work. You hereby agree to the terms and conditions herein, including the additional Terms & Conditions accompanying herewith.

B: Scope of work or items supplied, as per drawings, specifications and contract documents prepared by

Pricing includes the completion of work in a timely manner to meet or exceed time requirements for accelerated Westland schedule. Changes in the Purchase Order must be authorized in writing by Westland Construction's project director or project manager prior to work being performed. *See Terms & Conditions accompanying herewith.*

C: Unit prices not to exceed total Purchase Order amount of:

_____

Freight Included _____ Tax Included _____

Seller's Signature: **Buyer's Signature:**

_____ _____

Printed Name: **Nolan Kerr**
Title: **Project Manager**
SUBCONTRACTOR **WESTLAND CONSTRUCTION, INC.**

TERMS & CONDITIONS

1. **Acceptance.** This Purchase Order constitutes Buyer's offer to Seller and becomes a binding contract on the terms set forth herein when it is accepted by Seller, either by signing this Purchase Order or by the commencement of performance hereof. No revisions to this Purchase Order shall be valid unless in writing and signed by an authorized representative of Buyer prior to any work being performed. No conditions stated by Seller in accepting or acknowledging this Purchase Order shall be binding upon Buyer if in conflict with, inconsistent with, or in addition to the terms and conditions contained herein, unless expressly accepted in writing by Buyer. In the event of conflict in terms of Seller's contract proposal and this Purchase Order, the terms of this Purchase Order shall govern.

2. **Price Changes.** Prices specified on any purchase order accepted by Seller shall not be subject to change without Buyer's consent.

3. **Design Changes.** Buyer may at any time make changes in the applicable drawings, designs or specifications, or schedule. Adjustment of price resulting from such changes shall be made in proportion to the increase or decrease of cost to the Seller and shall be agreed to in writing from the Buyer prior to any change being implemented by the Seller.

4. **Packing & Crating.** All items shall be packed by Seller in suitable containers for protection in shipment and storage. Prices set forth in this Purchase Order include all charges for Seller's packing, crating, storage, and for transportation to F.O.B. point.

5. **Inspection.** All materials or articles will be subject to final inspection and approval at the Delivery Address by Buyer. Buyer reserves the right either to reject and hold, at Seller's expense subject to Seller's disposal, all materials or articles not conforming to drawings, specifications and/or samples if required under the terms of this Purchase Order, or to return without an order. If any merchandise fabricated by Seller from material furnished by Buyer is rejected by Buyer due to Seller's fault or failure to meet the requirements of drawings, specifications, and/or samples required under the terms of this Purchase Order, Seller shall, at Buyer's option, either replace such merchandise at its own expense or pay Buyer the replacement cost of the material used therein. Seller will be charged replacement costs of Buyer's materials or tools while in Seller's possession.

6. **Delivery.** Seller shall assume and pay any and all loss or damage to the materials and articles from any cause whatsoever until delivered to Buyer at the Delivery Address specified on this Purchase Order.

7. **Advance Manufacture and Shipments.** Seller shall not deliver any material in advance of the schedule set forth in this Purchase Order without Buyer's written permission. Buyer reserves the right to return, shipping charges collect, all material received at Buyer's ship to point in advance of their schedule shown on this Purchase Order. Seller may request Buyer's written consent to advance manufacture and/or deliver at time of returning acknowledgement of this Purchase Order. Shipments will be made in accordance with the Buyer's shipping schedule which is subject to revision with respect to undelivered quantities.

8. **Tools and Materials.** Title to and the right of immediate possession of all tooling, designs, patterns, drawings and materials furnished by Buyer to Seller for use hereunder shall be and remain in Buyer, in all stages of construction.

9. **Delays.** The Seller shall notify the Buyer promptly of any delays affecting the performance of this Purchase Order. The Seller shall indemnify the Buyer against any loss incurred by the failure of the Seller to perform in accordance with the accepted Purchase Order.

10. **Invoices.** Invoices and required Attachments should be received in the Westland Construction Orem office no later than the 25th of each month. Invoices are for work completed from the 1st through the 30th of the month. ALL billings must be on the Contractor's application for payment form. All invoices shall be paid by the 25th of the month following the month of invoice, or within 30 days after payment by Owner.

11. **Payment.** Payment for material on this Purchase Order shall not constitute an acceptance thereof, but all material shall be received subject to Buyer's inspection and rejection. Payment shall be made as stated on this Purchase Order, unless otherwise specifically arranged for and stated in this Purchase Order. In the event that merchandise has not been received, Buyer reserves the right to withhold payment until merchandise has been received and checked. Buyer's count will be accepted as final on all shipments not accompanied by packing list.

12. **General Warranty.** Seller warrants that all of the articles and all of the materials furnished under this Purchase Order are free and clear of all liens and encumbrances whatsoever and that Seller has a good and marketable title to same and Seller agrees to hold Buyer free and harmless against any and all claimants to said merchandise. Seller further warrants that all of the articles and all of the materials furnished under this Purchase Order will be free from defects in materials and workmanship, will conform to applicable specifications, drawings, samples or other descriptions given, and shall be fit and sufficient for the purpose intended, merchandisable of good material and workmanship, and free from defects. Said express warranty shall remain in effect as to each material and each article for a period of twelve (12) months after it is applied to a use for which it was designed. The foregoing period and time may be extended by written agreement and shall be deemed to be extended for such greater period of time as may be specified in Seller's standard warranty or service guarantee. The aforesaid express warranty shall be in addition to any standard warranty or service guarantee given to Buyer by Seller. All warranties shall be construed as conditions as well as warranties and shall not be deemed to be exclusive. All warranties and service guarantees shall run both to Buyer and to its customers. Seller will defend, indemnify, and save harmless Buyer from and against all claims of patent, trademark or copyright infringement of all unfair competition arising out of the sale, cataloging, marketing, packing, or advertisement of merchandise furnished by Seller; and against all claims for damages to person or property resulting from defects in material or workmanship, and/or from failure of Seller to comply with safety, inspection and labeling requirements of governmental agencies in force as applicable when goods are resold by Buyer.

13. **General Indemnity.** Seller, at its expense, shall (a) defend Buyer against any claim or action brought against Purchaser arising out of any act or omission of Seller, its agents, servants, employees or subcontractors during or resulting from fault performance of the goods purchased hereunder or any work performed under this Purchase Order and (b) indemnify and hold Buyer (and Buyer's successors in interest to the goods purchased hereunder) harmless from all claims, liabilities, losses, damages, costs, expenses and liabilities relating hereto (including without limitation reasonable attorney's fees). Seller shall have the right to control the defense of any such action and all negotiations for settlement. Buyer shall have the right, at its expense, to participate in the defense and settlement of such action and to be represented therein by counsel of its choice.

14. **Termination.** If the merchandise covered by this Purchase Order is standard stock merchandise, Buyer at its option may cancel at any time any unshipped portion of this Purchase Order without further obligation hereunder except to make payment, subject to other

applicable terms hereof. For merchandise manufactured or fabricated to the specifications of the Buyer, or special specifications prepared by Seller for Buyer, Buyer may terminate such work under this Purchase Order in whole, or in part, at any time by written or telegraphic notice to Seller; and upon such termination in whole, or in part of such work under this Purchase Order, Seller will stop work immediately, notify subcontractors to stop work, and protect property in Seller's possession in which Buyer has or may acquire an interest. Except where such termination is occasioned by a default or delay of Seller, other than one due to causes beyond Seller's control and without Seller's fault or negligence, Seller may claim reimbursement for Seller's actual costs incurred up to and including the date of termination which are properly allocable to or apportionable under recognized accounting practices to the terminated portion of the Purchase Order, including liabilities to subcontractors which are so allocable and acceptable finished units at contract price not previously billed or paid for, but excluding any charge for interest or any materials which Seller may be able to divert to other orders. Seller may also claim a reasonable profit on the work actually done by Seller prior to such termination, the rate of which shall not exceed the rate used in establishing the original Purchase Order Price. The total of such claim shall not, however, exceed the canceled commitment value of this Purchase Order.

15. **Patent Protection.** To the extent that the articles or materials delivered hereunder are not manufactured pursuant to designs originated by Buyer, Seller guarantees that the sale and/or use of any or all articles or materials delivered hereunder will not infringe any United States or foreign patents and agrees that Seller will save Buyer and/or its customers harmless from any loss, damage or liability which may be incurred on account of infringement or alleged infringement of patent rights with respect to such articles or materials, and that it will at its own expense defend any action, suit or claim in which such infringement is alleged, provided Seller is duly notified as to suits or claims against Buyer and provided further that Seller's indemnity as to use shall not apply to infringement arising from use in combination with other items where infringement would not have occurred from the normal use for which the article was designed.

16. **Insurance.** In the event that Seller is required to enter premises owned, leased, occupied by or under the control of Buyer during the performance of services ordered hereunder or during delivery or installation of materials or articles herein contemplated or during the performance of services otherwise required to be furnished by Seller, Seller agrees that Seller will indemnify and hold harmless Buyer, its officers and employees, from any loss, cost, damage, expense or liability by reason of property damage or personal injury of whatsoever nature or kind arising out of or as a result of the performance of such services and/or delivery and or installation, whether arising out of the actions of Seller or of its employees, subcontractors, or sub-subcontractors. Seller agrees that it and its subcontractors or sub-subcontractors will maintain public liability and property damage insurance in reasonable limits covering the obligations set forth above and will maintain proper workmen's compensation insurance covering all employees engaged in the performance of such services and/or delivery and/or installation.

17. **Reproduction Rights.** Buyer does not grant or convey to Seller by virtue of this Purchase Order (a) any reproduction rights in or to the articles called for hereunder or (b) any right to use designs, drawings or other information belonging to Buyer or supplied by or on behalf of Buyer for use in the performance of this Purchase Order for the production, manufacture or design of any articles or materials for anyone other than Buyer.

18. **Assignment.** Seller may not assign this Purchase Order, or sublet any part of this Purchase Order, without the prior written consent of Buyer. Claims for monies due or to become due under this Purchase Order may be assigned by Seller, provided that Seller shall supply Buyer promptly with two copies of any such assignment, and provided further that payment to an assignee of any claims under this Purchase Order shall be subject to set-off or recoupment for any present or future claim or claims which Buyer may have against Seller.

19. **Cancellation for Insolvency.** In the event of any suspension of payment or the institution of any proceedings by or against either party, voluntary or involuntary, in bankruptcy or insolvency, or for the appointment of a receiver or trustee or an assignee for the benefit of creditors of either party, or in the event of a breach of any other terms hereof, including warranties of Seller, the other party shall be entitled to cancel this Purchase Order forthwith, without liability for loss of anticipated profits.

20. **Integration.** In accepting this Purchase Order or making deliveries hereunder, Seller agrees to all of the terms and conditions stated on this Purchase Order. This Purchase Order, together with any written documents which may be attached hereto, and/or incorporated by specific reference, constitutes the entire agreement between the parties and supersedes all previous communications between them, either oral or written. All such previous communications are hereby abrogated and withdrawn, and no stipulations, representations or agreements by Buyer or any of its officers, agents or employees shall be binding on the Buyer unless reduced to writing and attached to and incorporated in this Purchase Order by reference as above provided and no local, general or trade custom shall alter or vary the terms hereof.

21. **Confidential.** The Seller shall not disclose any details connected with this Purchase Order to any third party except as may be required to insure performance, except as herein specified, without first obtaining the written consent of the Buyer.

22. **Governing Law.** This Purchase Order will be governed by the laws of the State of Utah, except for its conflict of laws rules.

23. **Jurisdiction & Venue.** This Purchase Order will be deemed to have been made, executed and delivered in Salt Lake City, Utah. The courts and authorities of the State of Utah will have exclusive jurisdiction over all controversies which may arise under or in relation to this Purchase Order, the parties hereto hereby consenting to service, jurisdiction, and waiving any other venue to which they might be entitled by virtue of domicile, habitual residence or otherwise.

Seller's Initials_____ **Buyer's Initials**_____

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Client#: 4267 WESTCONI

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: AGENCY CONTACT PERSON	
AGENT NAME AGENT ADDRESS AGENT PHONE	PHONE (A/C, No, Ext): PHONE	FAX (A/C, No): FAX
	E-MAIL ADDRESS: CONTACT EMAIL	
	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A : "A-", OR BETTER, "A" RATED CARRIER	
INSURED INSURED NAME INSURED ADDRESS	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE / X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY / X PRO-JECT / LOC OTHER:	X	X	POLICY NUMBER	XX/XX/XX	XX/XX/XX	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG 	$1,000,000 $100,000 $5,000 $1,000,000 $2,000,000 $2,000,000 $
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS / SCHEDULED AUTOS X HIRED AUTOS / X NON-OWNED AUTOS	X	X	POLICY NUMBER IF "ANY AUTO" IS NOT CHECKED, THEN ALL THREE OF THE FOLLOWING MUST BE CHECKED: OWNED, HIRED, NON-OWNED.	XX/XX/XX	XX/XX/XX	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) 	$1,000,000 $ $ $ $
	UMBRELLA LIAB / OCCUR EXCESS LIAB / CLAIMS-MADE DED / RETENTION $						EACH OCCURRENCE AGGREGATE 	$ $ $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		POLICY NUMBER	XX/XX/XX	XX/XX/XX	X PER STATUTE / OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $100,000 $100,000 $500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

PROJECT: Tooele County School District - 649

WESTLAND CONSTRUCTION, INC., ARCHITECT AND OWNER ARE NAMED AS ADDITIONAL INSUREDS AS RESPECTS TO GENERAL LIABILITY IF REQUIRED BY WRITTEN CONTRACT PER (ENDORSEMENT FORM #). WAIVER OF SUBROGATION AND PER PROJECT AGGREGRATE LIMIT OF LIABILITY SHALL APPLY; SUCH INSURANCE AS IS AFFORDED BY THIS POLICY SHALL BE PRIMARY AND NON-CONTRIBUTORY. SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE, 30 DAYS WRITTEN NOTICE (10 DAYS FOR NON-PAYMENT) WILL BE DELIVERED TO THE CERTIFICATE HOLDER.

CERTIFICATE HOLDER	CANCELLATION
WESTLAND CONSTRUCTION, INC. ATTN: INSURANCE COORDINATOR 1411 WEST 1250 SOUTH, SUITE 200 OREM, UT 84058	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

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SECTION 00 6276.13

SALES TAX EXEMPTION CERTIFICATE

PART 1 - GENERAL

1.1 SUMMARY

A. Construction materials purchased by or on behalf of the Tooele School District *may be* exempt from Utah sales and use taxes. The appropriate Tax Exempt Form must be used by the vendor when purchasing construction materials for District projects. A copy of the Form which has been completed and signed by the District's Chief Procurement Office or designee will be made available to the successful bidders.

B. Contractors assume all responsibility for correct use of exemption form and for filing all necessary paperwork with the State of Utah, including all costs associated with audits or other reviews required by the State.

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SECTION 00 7000

GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. **AIA Document A201 - General Conditions of the Contract for Construction** is incorporated by reference. Copies may be obtained from the Architect for the cost of reproduction.

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SECTION 00 7300

SUPPLEMENTARY GENERAL CONDITIONS

A. The Supplementary Conditions herein described, contain changes and additions to Section 00 7000 - AIA Document A201, 2017 edition, General Conditions of the Contract for Construction. Where any part of the General Conditions is modified by these Supplementary Conditions, the unaltered provisions shall remain in effect.

ARTICLE 1 CONTRACT DOCUMENTS

Add the following:

"1.1.1.1 The Invitation to Bid and Bid Proposal Form shall be part of the Contract Documents."

Add the following:

"1.2.1.2 Where a conflict exists in the Contract Documents, the greater quantity, higher quality, or more restrictive requirement, as determined by the Architect, shall apply."

Add the following:

"1.5.3 Release of Electronic Media Drawing Files: An agreement titled "Agreement Concerning Drawing Files on Electronic Media" must be signed and returned to VCBO Architecture prior to release of any documents. A copy of the release follows this section.

ARTICLE 3 CONTRACTOR

Delete original paragraph 3.7.1 and substitute the following:

"3.7.1 The Contractor shall secure and the Owner shall pay for any permits, fees, and inspections required by work included in this Contract. All licensing shall be secured and paid for by Contractor."

Add the following:

"3.8.4 At close-out of Contract, funds remaining in the Contingency Allowance will be credited to the Owner by Change Order."

Modify the following:

3.10.1 ***Delete*** in the first sentence "... promptly..." and ***substitute*** "... within 24 hours..."

Add at the end of 3.10.1:

"This schedule shall be prepared in accordance with the requirements outlined in **Section 01 3300**, **Submittals** (1.3)."

ARTICLE 5 SUBCONTRACTORS

Modify the following:

5.2.1 ***Delete*** in the first sentence "... as soon as practicable..." and ***substitute*** "... within 24 hours..."

***Delete* 5.2.4** and substitute the following:

"5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected without written notification and approval of the Owner and Architect."

ARTICLE 7 CHANGES IN THE WORK

Add the following:

“7.1.4 Subcontractors shall be limited to 10 percent mark-up for allowed profit and overhead on proposed changes and modifications. CM/GC shall be limited to 10 percent mark-up for allowed profit and overhead on proposed changes and modifications.”

ARTICLE 8 TIME

Add the following:

"**8.4 Liquidated Damages**

.1 The Contractor and Contractor's Surety shall be liable for and shall pay the Owner the sums hereinafter stipulated as liquidated damages of One Thousand Five Hundred Dollars per Day ($1500.00) for each calendar day of delay beyond the scheduled completion date until Work is substantially complete and One Hundred Dollars per day ($100.00) for each calendar day of delay for shop drawings/submittals received beyond 90 days after Notice of Award. Each trade shall complete their respective work within the General Contractor's construction schedule.

.2 Should the Contractor fail to complete the work within the General Contractor's construction schedule included herein, or within such additional time as may have been allowed by extension, there shall be deducted from any moneys due or that may become due the Contractor the sum as stated in the Agreement. Such sum is fixed and agreed upon by the Owner and the Contractor as liquidated damages due the Owner by reason of the inconvenience and added costs of administration, engineering, and supervision resulting from the Contractor's default, and not as a penalty.

.3 Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the Owner of any of his rights under the agreement.

.4 Protection of the top of masonry walls shall be provided as indicated in Division 4 Section “Unit Masonry Assemblies” or a liquidated damage amount of $500.00 per calendar day shall be assessed for each day the top of masonry is not protected."

ARTICLE 9 PAYMENTS AND COMPLETION

Add the following:

“9.3.1.3 Payments made shall be 95 percent of scheduled values requested by each application for payment. Retainage shall be 5 percent and shall be retained until application for final payment is made at the completion of work. Amounts withheld as retainage will be held in an interest bearing account.”

ARTICLE 11 INSURANCE AND BONDS

Add the following:

"11.1.1.1 Insurance limits may be obtained from the Owner.”

Add the following:

“11.1.1.2 The Owner and Architect shall be named as additional insured in the policies required by the Contract Documents.”

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

Add the following;

"12.2.6 Special Project Warranty: Contractor shall warrant the Work of this Contract, in which Contractor agrees to repair or replace all assemblies and components that fail to remain weather-tight, including leaks, including but not limited to, all components of the membrane roofing system, flashings, rooftop mounted accessories or equipment, windows and glazing, doors and frames, storefronts and curtain walls, sealants, exterior wall coverings or claddings, for the following warranty period:
1. Weather-tight Warranty Period: Three years from date of Substantial Completion."

ARTICLE 13 MISCELLANEOUS PROVISIONS

Add the following:

"13.6 INDEMNIFICATION

13.6.1 To the fullest extent permitted by law, Contractor shall indemnify, defend, and hold harmless Owner and Architect and their agents, affiliates, and employees from and against all claims, liabilities, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from the performance of the work, provided that any such claim, liability, damage, loss or expense (1) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom (other than the Work itself or Owner's property), and (2) is caused by whole or in part by an negligent act or omission of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Paragraph 4.18 or in Article 17 hereof.

13.6.2 In any and all claims against Owner or Architect or any of their agents or employees by any employee of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation under this Paragraph 4.18 shall not be limited in any way by an limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts."

END OF SECTION

AGREEMENT CONCERNING DRAWING FILES ON ELECTRONIC MEDIA

Valentiner Crane Brunjes Onyon Architects, L.L.C. (the Architect) does not assume any responsibility for the accuracy of the information contained in the electronic drawing files. Any and all users are aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed and sealed hard-copy construction documents prepared by the Architect and the electronic files, the signed or sealed hard-copy construction documents shall govern.

Any and all users who may obtain these drawings from the General Contractor under this agreement, including but not limited to; subcontractors, vendors, suppliers etc., agree to indemnify and hold harmless the Architect, its officers, directors, employees and sub-consultants against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the Architect or from any transfer or reuse of the electronic files without the prior written consent of the Architect.

Under no circumstances shall delivery of the electronic files be deemed a sale by the Architect, and the Architect makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall the Architect be liable for any loss of profit or any consequential damages as a result of the use or reuse of the electronic files.

The drawing files provided will contain information as provided on construction documents. The user shall remove all notes, text, detail cuts and member designations from the electronic file prior to use. If used as submittal documents, submittals will be rejected if non-compliant. The drawing files provided by VCBO may not be reproduced or distributed to individuals outside the company or collective organization signing this agreement.

LIST OF DRAWINGS:

Project Name: Davis School District Elementary School Kitchen Remodels
VCBO Project Number: 19205

List of Drawings: Floor Plans, Reflected Ceiling Plans, Building Sections.

_____

ACCEPTANCE OF TERMS, CONDITIONS & LIMITATIONS:

_____ _____
Name of Company/Contractor Signature of Company/Contractor Representative

_____
Printed Name of Individual Signing

_____ _____
Position/Title Date

This agreement must be signed and returned to VCBO prior to release of any electronic document.

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DIVISION 01 - GENERAL REQUIREMENTS

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SECTION 01 1000

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements of Division 00 “Procurement and Contracting Requirements and Division 01 - General Requirements apply to every section contained in the Project Manual, and shall govern the execution of Work required by the Contract Documents.

B. Provide everything necessary for and incidental to proper and satisfactory completion of all Work specified and indicated or shown in the Contract Documents.

C. The Project consists of the renovations to Warehouse 649 for the Tooele County School District.

1.2 PROJECT LOCATION

A. Location of Warehouse 649: 180 Garnet Street, Tooele, Utah.

1.3 SEPARATE CONTRACTS

A. **The Owner may enter into separate contracts for construction**. Each contractor shall be responsible to coordinate efforts with other trade contractors to ensure timely completion of the work.

B. **Coordinate the Work** of this contract with the work of separate contractors to ensure timely completion of the work.

1.4 CODES

A. **Law of place of building governs**. Conform to applicable requirements of the latest editions of the International Building Code, International Building Code Standards, International Mechanical Code, International Plumbing Code, National Electrical Code, National Fire Protection Association requirements, local ordinances, and UOSHA requirements applicable to this project, unless a higher standard is called for, without additional cost to the Owner.

B. **Comply** with **CABO/ANSI A117.1**, American National Standard, "Accessible and Usable Buildings and Facilities" latest edition which is in force for the project location, for handicapped accessibility.

1.5 CONTRACTOR USE OF PREMISES

A. **General:** During the construction period the Contractor shall have use of the premises for construction operations, including:
   1. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project

B. **Use of the Site**: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
   1. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
   2. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary obtain and pay for such storage off-site.
   3. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

1.6 DUST CONTROL

A. **Provide continuous** (7 days per week, 24 hours per day) **fugitive dust control measures** within the limits of the construction site, related sites and adjacent streets and roads. Dust control shall be provided for, but not be specifically limited to, the stabilization of unpaved roads, haul roads, access roads, spoil sites, borrow and material sources, excavations, embankments, stockpiles, and all other areas which become potential sources of dust as a result of construction activities.

B. **Maintain compliance with General Utah Air Pollution Regulations**, R446 - Utah Air Conservation Regulations, Section 4.5, Fugitive Emissions, applicable County Air Pollution Control Ordinances, and as directed by the Architect. Dust control measures shall include but not be limited to the following:
   1. Wetting of surfaces with water as appropriate.
   2. Minimizing surface disturbances.

C. **In order to control fugitive dust emissions**, apply the following procedures and techniques:
   1. Cover loads of materials, debris and waste materials taken from construction sites as needed to suppress dust during transit.
   2. Water down or apply other approved dust control measures to the construction site, haul roads and public access roads as needed to suppress dust.
   3. All mud and dirt shall be removed from vehicles prior to entering a paved or graveled area or road. Any mud or dirt that is carried out onto paved or graveled surfaces shall be removed from surfaces immediately and no less than daily.

1.7 INCIDENTAL WORK

A. **Any work**, **materials or equipment that may reasonably be inferred** from the Contract Documents as being required to produce the intended result shall be supplied by the Contractor at no additional cost to the owner whether or not specifically called for in the Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 1900

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. **Definitions**: Basic Contract definitions are included in the General Conditions.

1. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
2. Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
3. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
4. 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."
5. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

B. **Specification Format and Conventions:**

1. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
   a. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
2. Specification Content: The Specifications use certain conventions for style of language and the intended meaning of terms, words, and phrases when used in particular situations. These conventions are as follows.
   a. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   b. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      1) 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.

C. **Drawing Symbols**:

1. Graphic symbols: Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., latest edition.
    a. Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical Drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by more specific symbols recommended by technical associations including ASME, ASPE, IEEE, and similar organizations. Refer instances of uncertainty to the Architect for clarification before proceeding.

D. **Industry Standards**:

1. Applicability of Standards: Except where 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. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Project Site for reference.
2. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.
3. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.
4. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
    a. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
    b. Although copies of standards needed for enforcement of requirements also may, be included as part of required submittals, the Architect reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.

E. **Abbreviations and Names**: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

END OF SECTION

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. **Related Sections** include the following:
   1. Section 01 6000 "**Product Requirements**" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 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, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. **Owner-Initiated Proposal Requests**: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request 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 an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. **Contractor-Initiated Proposals**: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the 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 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.
   5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. **Proposal Request Form**: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

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

1.6 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 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section specifies** administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. **Related Sections** include the following:
   1. Section 01 2600 "**Contract Modification Procedures**" for administrative procedures for handling changes to the Contract.

1.3 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.

1.4 SCHEDULE OF VALUES

A. **Coordination**: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   2. Application for Payment forms with Continuation Sheets.
   3. Submittals Schedule.
   4. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   5. Sub-schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. **Format and Content**: Use the 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. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value.
        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. **General**: Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. **Payment Application Times**: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. **Payment Application Forms**: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. **Application Preparation**: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. **Transmittal**: Submit 3 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.

F. **Waivers of Mechanic's Lien**: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
      a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. **Initial Application for Payment**: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.
   6. Submittals Schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.
   15. Data needed to acquire Owner's insurance.
   16. Initial settlement survey and damage report if required.

H. **Application for Payment at Substantial Completion**: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. **Final Payment Application**: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes **administrative provisions for coordinating construction operations** on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Conservation.
   3. Coordination Drawings.
   4. Administrative and supervisory personnel.
   5. Project meetings.

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

C. **Related Sections**: The following Sections contain requirements that relate to this Section:
   1. Section 01 7300 "**Execution Requirements**" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   2. Section 01 3300 "**Submittals**" for procedures for coordinating electronic submittals.
   3. Section 01 7700 "**Closeout Procedures**" for coordinating Contract closeout.

1.3 COORDINATION

A. **Coordination**: Coordinate construction operations included in various 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. **Memoranda**: If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such 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 and activities of other contractors 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.

D. **Administrative Software Requirements**: The General Contractor shall submit all project related information (i.e. Submittals, RFI's, ASI's, Addenda, Construction documents, Project logs, Field reports, and Meeting minutes) using the Architect's File Transfer Site. Architect will provide access information to the General Contractor at the pre-construction meeting or as appropriate to the schedule of the project.
1. The General Contractor shall employ a PDF review software system such as Blue Beam (www.bluebeam.com) or another similar system for producing, formatting, and marking-up project related documents. The General Contractor shall review all the documents and add their stamp and comments directly to the PDF prior to posting for the Design team to review.
2. General Contractor shall provide to the Architect and Owner, an electronic archive of all data at the end of the project via DVD(s) for final project records.

E. **Contractor is to keep a printed record** of all Construction Documents including all clarifications, RFI's and approved changes to the Contract on site.

F. **Conservation**: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

A. **Coordination Drawings**: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to Division 23 Section "Basic Mechanical Materials and Methods" and Division 26 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

B. **Staff Names**: Within 5 business days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

C. **Submittal Log**: See section 'Submittals' for electronic delivery and record keeping.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. **General**: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
   1. Include special personnel required for coordination of operations with other contractors.
   2. The General Contractor shall have a superintendent on the project whenever Sub-contractors are working on the project.

1.6 PROJECT MEETINGS

A. **General**: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. **Preconstruction Conference**: Schedule 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. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All 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. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing.
      d. Designation of responsible personnel.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for processing Applications for Payment.
      g. Distribution of the Contract Documents.
      h. Submittal procedures including access information to the Architect's File Transfer Site.
      i. Preparation of Record Documents.
      j. Use of the premises.
      k. Responsibility for temporary facilities and controls.
      l. Parking availability.
      m. Office, work, and storage areas.
      n. Equipment deliveries and priorities.
      o. First aid.
      p. Security.
      q. Progress cleaning.
      r. Working hours.
   3. Documentation: Furnish Architect certificate of insurance naming VCBO as an

additional insured.

C. **Progress Meetings**: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. 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.
    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 utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.
        14) Documentation of information for payment requests.
3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
    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.

1.7 REQUESTS FOR INFORMATION (RFI)

A. **Procedure**: Immediately on discovery of the need for interpretation of Contract Document, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. Request shall originate with General Contractor. RFI's submitted by entities other than General Contractor will be returned with no response.
2. Coordinate and submit RFI's in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect and Owner.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.
   9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contractor Time or the Contract Sum, Contractor shall state impact in the RFI.
   10. Contractor's signature.
   11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thickness, structural grid references, and details of affected materials, assemblies, and attachments.

C. **Hard-Copy RFI's**: Use the form supplied by the Architect or the Owner.
   1. Identify each page of attachments with the RFI number and sequential page number.
   2. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. **Electronic RFI's**:
   1. RFI's shall be processed and delivered electronically through Architect's File Transfer Site with sequential numbers.

E. **Architect's Action**: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFI's received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFI's will be returned without action:
      a. Requests for approval of submittals.
      b. Request for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Request for adjustments in the Contract Time or Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFI's or RFI with numerous errors.
   2. Architect's action may include a request for additional information, in which case Architect's Time for response will start again.
   3. Architect's action on RFI that may result a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner in writing within 10 calendar days of receipt of the RFI response.

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

G. **RFI Log**: Prepare, maintain, and submit a tabular log of RFI's organized by RFI number. Submit log monthly.
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect and Owner.
   4. RFI number including RFI's that were dropped and not submitted.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's and Owner's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
   9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 3300

SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies **administrative and procedural requirements for submittals** required for performance of the Work, including:
   1. Contractor's construction schedule.
   2. Daily construction reports.
   3. Shop Drawings.
   4. Product Data.
   5. Samples.
   6. Deferred Submittals for review by the Building Code Official.

B. **Administrative Submittals:** Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
   1. Applications for payment.
   2. Performance and payment bonds.
   3. Insurance certificates.
   4. List of Subcontractors.

C. **Inspection and test reports** are included in Division 1 Section "Quality Control Services."

D. **Related Documents**:
   1. Section 01 3100 "**Project Management and Coordination**": Electronic web-based construction administration software.

1.3 ELECTRONIC SUBMITTAL DELIVERY

A. **To minimize printing reimbursables**, shipping reimbursables and the impact on the environment, submittals shall be processed and delivered electronically.
   1. A single hard copy shall also be furnished, if requested by the Architect.

B. **The Construction Manager or Contractor** must first review and approve all submittals sent by Subcontractors prior to sending to design team. Include Contractor's certification that information complies with Contract Document requirements, record deviations from Contract Document requirements, including minor variations and limitations. Submittals uploaded by subcontractors shall not be visible to the Design team until the submittal becomes official and is forwarded from the Construction Manager or Contractor to the Design team with a transmittal.

C. **Submittals must follow the requirements outlined** in this specification and as required in individual specification sections.

D. Deliver the **following types of submittals** to the design team electronically in pdf format:
1. Product Data
2. Shop Drawings
3. Certifications
4. Test Data
5. Schedules
6. Calculations
7. Mix Designs
8. Warranty Information

E. **Samples and Color Selection**
1. All samples/color selections shall be delivered by mail or courier to the design team for review.
2. See separate specification sections for quantities and sample selection process. The design team shall return review comments electronically.

F. **Submittal Stamps**
1. The Contractor or Construction Manager shall affix an electronic stamp to PDF submittals.

G. **Submittal Logs**
1. Design team shall maintain a submittal log through the Architect's internal electronic filing system.
2. Construction team shall make a reasonable effort to deliver all submittals electronically.
4. Samples shall be delivered hardcopy by mail

1.4 SUBMITTAL PROCEDURES

A. **No submittal will be accepted** by the Architect **without the General Contractor's action stamp**, clearly visible, indicating that the submittal has been fully reviewed by the General Contractor for compliance to the Construction Documents.

B. **Submittals** with the General Contractor's stamp but **not in compliance with the Construction Documents** will be deemed incomplete and **returned without review**. These will not be shown as received.

C. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. **Processing Time**: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
   1. Initial Review: Allow 15 business days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 20 business days for initial review of each submittal.
   3. Deferred Submittal Review: Where deferred submittals are required by the Building Code Official allow review time as dictated by the Official.
   4. If intermediate submittal is necessary, process it in same manner as initial submittal.
   5. Allow 15 business days for processing each resubmittal.
   6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. **Submittal Preparation**: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
   1. Include the following information on the label for processing and recording action taken.
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Contractor.
      e. Name and address of Subcontractor.
      f. Name and address of Supplier.
      g. Name of Manufacturer.

F. **Submittal Transmittal**: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
   1. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

G. **Submittal requirements** for electronic PDF submittals:
   1. All submittals shall be created with native PDF files whenever possible. Do not print a PDF file, and scan in as an image file, as this will delete all file search functions typically embedded within a native PDF file.
   2. All PDF submittals shall be broken down by individual specification section. Do not collate multiple specification sections together into one non-separated submittal package (i.e. carpet, VCT, rubber base, and entry mats; though frequently provided by one installer, shall not be submitted as one non-separated package unless formatted as described below.)
   3. All PDF submittals that cover multiple items within one specification section, or PDF submittals that include multiple related specification sections shall have an index and be formatted with electronic book marks to distinguish various components from one another, and make each item easily retrievable without navigating through each page of an entire submittal.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. **Bar-Chart Schedule**: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
   2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
   3. Prepare the schedule on a sheet of sufficient width to show data for the entire construction period.
   4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
   5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
   6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. **Distribution**: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. **Schedule Updating**: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. **Daily Construction Report**: Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
   1. List of subcontractors at the site.
   2. Approximate count of personnel at the site.
   3. High and low temperatures, general weather conditions.
   4. Accidents and unusual events.
   5. Meetings and significant decisions.
   6. Stoppages, delays, shortages, losses.
   7. Meter readings and similar recordings.
   8. Orders and requests of governing authorities.
   9. Change Orders received, implemented.
   10. Services connected, disconnected.

B. **Material Location Reports**: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. **Field Condition Reports**: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.7 SPECIAL REPORTS

A. **General**: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. **Reporting Unusual Events**: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1.8 SHOP DRAWINGS

A. **Submit in timely manner** to complete project, but no later than 90 days after Notice of Award.
   1. A fee of $100.00 will be charged by the Owner, per submittal for all submittals past this date.

B. **Submit newly prepared information**, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.

C. **Shop Drawings include** fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.

D. **Sheet Size:** Submit Shop Drawings, layout drawings and other Revit or CADD style sheets formatted for 24 x 36 inch or 30 x 42 inch sheets. Details and drawings are to match or exceed construction bid document scales. All drawings are to be submitted to scale. All other product brochures and cut sheets can be provided in an 8-1/2 x 11 format.

E. **Final Electronic Submittal:** Submit 2 prints, one for the Architect and one for the Owner at the end of the project or as requested by the parties during construction.
   1. If submittal was reviewed by members of the design team other than the Architect, provide an additional copy of the submittal for each design firm.
   2. The prints shall be marked-up and maintained as a "Record Document".

F. **Final Submittal:** Submit 5 prints. 2 prints will be retained; the remainder will be returned.
   1. One of the prints returned shall be marked-up and maintained as a "Record Document".
   2. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.9 DEFERRED SUBMITTALS

A. **Certain building elements are specified to be designed** under the direction of the supplier or subcontractors. See the General Information sheet on the drawings for a list of required deferred submittals.

B. **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.

C. **Delegated-Design Services Certification**: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and one paper copy 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.

D. **Submit deferred submittals on same size sheet** as original drawings (30 x 42 or 8 1/2 x 11). Drawings and calculations shall be on the Design Professional's title block stating the project name and all other items specified under 'Submittal Preparation' above.

E. **Submit deferred submittals to the Architect** who will disperse copies to the Building Code Official for review as required by the IBC.

F. **Contractor shall include these submittal sheets** in the Record Documents.

1.10 PRODUCT DATA

A. **Submit in timely manner** to complete project, but no later than 90 days after Notice of Award.

B. **Collect Product Data into a single submittal** for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with recognized trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.

C. **Do not submit Product Data until** compliance with requirements of the Contract Documents has been confirmed.

D. **Submittals**: Submit one hard copy and one electronic copy of each required submittal; submit additional copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.

E. **Electronic Submittals**: Submit a pdf copy and a hard copy of each required submittal; include copies where required for maintenance manuals. See electronic submittal delivery and submittal procedures for further requirements

1.11 SAMPLES

A. **Submit in timely manner** to complete project, but no later than 90 days after Notice of Award.

B. **Samples**: Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.

C. **Submittals**: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

1. Maintain sets of samples and a file of product submittals, as returned, at the Project site, for quality comparisons and product verification throughout the course of construction.

1.12 CONTRACTOR'S REVIEW

A. **Contractor's Review**: Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. **Approval Stamp**: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

C. **Submittals not marked** with an approval stamp and those not in compliance with the Construction Documents **shall be returned** without further review. It is the Contractor's responsibility to review submittals for compliance prior to forwarding the submittal to the Design Team for review.

1.13 ARCHITECT'S ACTION

A. **Architect's Action**: Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
   1. Compliance with specified characteristics is the Contractor's responsibility.

B. **Action Stamp**: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.
   1. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for; confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 4000

QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section specifies administrative** and **procedural** requirements for quality control services.

B. **Quality control services include inspections** and **tests** and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

C. **Inspection and testing services are required** to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
   1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities.
   2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

D. **Requirements for the Contractor** to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

A. **Contractor Responsibilities**:
   1. Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services shall be included in the Contract Sum.
      a. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor’s responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
      b. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner’s responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
   2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

3. Cost of Retesting: Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
4. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
    b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
    c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    d. Security and protection of samples and test equipment at the Project site.

B. **Owner Responsibilities**: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

C. **Duties of the Testing Agency**: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

D. **Coordination**: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

A. **The independent testing agency** shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
   a. Date of issue.
   b. Project title and number.
   c. Name, address and telephone number of testing agency.
   d. Dates and locations of samples and tests or inspections.
   e. Names of individuals making the inspection or test.
   f. Designation of the Work and test method.
   g. Identification of product and Specification Section.
   h. Complete inspection or test data.
   i. Test results and an interpretations of test results.
   j. Ambient conditions at the time of sample-taking and testing.
   k. Name and signature of laboratory inspector.
   l. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. **Qualification for Service Agencies**: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
   1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TESTS REQUIRED

A. **Tests required may include** but not be limited to the following (all items listed here may not occur, see Drawings and associated section of the Specifications):
   1. Soil compaction.
   2. Concrete.
   3. Welding.
   4. High strength bolts.
   5. Structural masonry.

B. **It is recommended** that the Contractor arrange for soils compaction and any other soils-related testing to be performed by or through the same firm that provided the initial soils investigation data. A copy of the soils investigation data is included with the project manual or if not included may be obtained from the Architect's Office upon request. The soils investigation is included for reference only.

3.2 REPAIR AND PROTECTION

A. **General:** Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
   1. Protect construction exposed by or for quality control service activities, and protect repaired construction.
   2. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** requirements for **temporary facilities** and **controls**, including temporary utilities, support facilities, and security and protection facilities.

B. **Temporary utilities include**, but are not limited to, the following:
1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.
9. Facsimile machine.

C. **Support facilities** include, but are not limited to, the following:
1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary elevator usage.
9. Temporary stairs.
10. Construction aids and miscellaneous services and facilities.
11. First aid station.

D. **Security and protection facilities** include, but are not limited to, the following:
1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Covered walkways.
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

E **Related Sections** include the following:
1. Section 01 3300 "**Submittals**" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Section 01 7300 "**Execution Requirements**" for progress cleaning requirements.
3. **Divisions 2 through 48** for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

A. **Permanent Enclosure**: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather-tight; exterior walls are insulated and weather-tight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. **General**: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. **Sewer Service**: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. **Water Service**: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. **Electric Power Service**: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.5 QUALITY ASSURANCE

A. **Standards**: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. 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.

1.6 PROJECT CONDITIONS

A. **Temporary Utilities**: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall 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.

B. **Conditions of Use**: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **General**: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. **Chain-Link Fencing**: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

C. **Lumber and Plywood**: Comply with requirements in Division 6 Section "Miscellaneous Carpentry."

D. **Tarpaulins**: Fire-resistive labeled with flame-spread rating of 15 or less.

E. **Water**: Potable.

2.2 EQUIPMENT

A. **General**: Provide equipment suitable for use intended.

B. **Field Offices**: Prefabricated or mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

C. **Fire Extinguishers**: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. **Self-Contained Toilet Units**: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. **Drinking-Water Fixtures**: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees F.

F. **Heating Equipment**: Unless Owner authorizes use of permanent heating system, 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, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

G. **Electrical Outlets**: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

H. **Power Distribution System Circuits**: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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.

B. **Provide each facility ready for use** when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. **General**: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   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. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. **Sewers and Drainage**: Provide temporary connections to remove effluent that can be discharged lawfully.
   1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to municipal system as directed by sewer department officials.

3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. **Water Service**: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
1. Provide rubber hoses as necessary to serve Project site.
2. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot hose. Provide one hose at each outlet.
3. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

D. **Sanitary Facilities**: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
   a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees F.

E. **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 from that specified that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of 50 degrees F in permanently enclosed portions of building for normal construction activities, and 65 degrees F for finishing activities and areas where finished Work has been installed.

F. **Ventilation and Humidity Control**: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. **Electric Power Service**: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install power distribution wiring overhead and rise vertically where least exposed to damage.
2. Connect temporary service to Owner's existing power source, as directed by electric company officials.

H. **Electric Distribution**: Provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   2. Provide warning signs at power outlets other than 110 to 120 V.
   3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
   4. Provide metal conduit enclosures or boxes for wiring devices.
   5. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

I. **Lighting**: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Provide one 100-W incandescent equivalent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
   3. Provide one 100-W incandescent equivalent lamp every 50 feet in traffic areas.
   4. Provide one 100-W incandescent equivalent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
   5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.

J. **Telephone Service**: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
   1. Provide additional telephone lines for the following:
      a. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
      b. Provide a dedicated telephone line for each facsimile machine and computer with modem in each field office.
      c. Provide a separate telephone line for Owner's use.
      d. Install a telephone on every second or third story of construction.
   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. Architect's office.
      e. Engineers' offices.
      f. Owner's office.
      g. Principal subcontractors' field and home offices.
   3. Provide an answering machine or voice-mail service on superintendent's telephone.
   4. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

5. Provide a computer and printer for Contractor's, Owner's, Architect's and other members of the Construction Team's use in making and receiving correspondence from the Architect and subcontractors. Provide with internet-enabled routing and wireless access for e-mail communication and use of wireless devices. Computer shall conform to the following:
   a. Processor: Intel Core2 Duo or Intel i3, i5, i7, 2.5 GHz processing speed.
   b. Memory: 4 gigabyte.
   c. Disk Storage: 250 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
   d. Display: 22-inch LCD monitor with 256-Mb dedicated video RAM.
   e. Full-size keyboard and mouse.
   f. Network Connectivity: 10/100BaseT Ethernet. If encrypted, provide both SSID and encryption password to Architect and Owner.
   g. Operating System: Microsoft Windows 7 or higher.
   h. Productivity Software:
      1) Microsoft Office Professional, 10 or higher, including Word, Excel, and Outlook.
      2) Adobe Reader 9.0 or higher.
      3) WinZip 7.0 or higher.
   i. 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.
   j. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 1.5 Mbps upload and 3 Mbps download speeds at each computer.
   k. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
   l. Backup: External hard drive, minimum 1 TB, with automated backup software providing daily backups.
   m. Wireless Coverage: Wireless service shall extend over entire construction area, including each floor.

3.3 SUPPORT FACILITIES INSTALLATION

A. **General**: Comply with the following:
   1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
   2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
   3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. **Temporary Roads and Paved Areas**: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
   1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 inches.
   2. Provide gravel paving course of subbase material not less than 3 inches thick; roller compacted to a level, smooth, dense surface.
   3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. **Traffic Controls**: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

D. **Dewatering Facilities and Drains**: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. 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 property nor endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
3. Remove snow and ice as required to minimize accumulations.

E. **Project Identification and Temporary Signs**: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
2. Prepare temporary signs to provide directional information to construction personnel and visitors.
3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
5. Provide one 72 inches high x 96 inches wide project sign with text as follows:
    a. Name of Project - allow 2 lines.
    b. Name of Owner - allow 2 lines.
    c. Owner’s Logo - allow 24 inches x 16 inches space.
    d. Name of Architect - allow 4 lines.
    e. Architect’s Logo - allow (2) 24 inches x 16 inches spaces.
    f. Name of Contractor - allow 2 lines.
    g. Contractor’s Logo - allow 24 x 16 inches.
    h. Allow 24 additional lines.
    i. Allow for rendering of building.

F. **Waste Disposal Facilities**:

1. Establish a system for daily collection and disposal of waste or extraneous materials from all construction areas on site that may present a hazard to the project, its craftsmen and the expeditious construction of the work. The Contractor shall provide to the Owner a satisfactory method to assure clean-up is performed in a timely and expeditious fashion. Enforce requirements strictly. Do not hold collected materials at the site longer than 7 days during normal weather or 3 days when the daily temperature is expected to rise above 80 degrees F. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.
    a. Burying or burning of waste materials on the site will not be permitted.
    b. Washing waste materials down sewers or into waterways will not be permitted.
    c. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of lunch garbage and similar wastes by construction personnel.

2. The Owner reserves the right to withhold payments and perform the clean-up, if necessary, at the expense of the Contractor, if unsatisfactory clean-up efforts are not performed in a timely fashion.

G. **Common-Use Field Office**: Provide an insulated, weathertight, air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 12 persons at Project site. Keep office clean and orderly.

1. Furnish and equip offices as follows:
   a. Desk and four chairs, four-drawer file cabinet, a plan table, a plan rack, and bookcase.
   b. Provide a room of not less than 240 sq. ft. for Project meetings. Furnish room with conference table, 12 folding chairs, and 4-foot- square tack board.
2. Provide resilient floor covering and painted gypsum wallboard walls and acoustical ceiling. Provide operable windows with adjustable blinds and insect screens.
3. Provide an electric heater with thermostat capable of maintaining a uniform indoor temperature of 68 degrees F. Provide an air-conditioning unit capable of maintaining an indoor temperature of 72 degrees F.
4. Provide fluorescent light fixtures capable of maintaining average illumination of 20 fc at desk height. Provide 110- to 120-V duplex outlets spaced at not more than 12-foot intervals, 1 per wall in each room.
5. **Owner's Inspector's Office:** Provide a separate office/trailer, minimum 8 feet x 12 feet, to be used by the Owner's inspector. Office shall be equipped with a separate phone line, fax line, bottled water facility, lighting, heat, cooling and minimum 6 foot long plan table. Entrance to office shall be controlled by the Owner.

H. **Storage and Fabrication Sheds**: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

I. **Lifts and Hoists**: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. **Temporary Stairs**: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. **Environmental Protection**: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. **Stormwater Control**: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. **Tree and Plant Protection**: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. **Pest Control**: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

E. **Site Enclosure Fence**: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
   1. Set fence posts in concrete bases.
   2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
   3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

F. **Security Enclosure and Lockup**: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

G. **Barricades, Warning Signs, and Lights**: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
   1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- thick exterior plywood.

H. **Covered Walkway**: Where required, erect a structurally adequate, protective, covered walkway for passage of persons along adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

I. **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 not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
   2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.

3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

J. **Temporary Partitions**: 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 studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on construction side.
2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

K. **Temporary Fire Protection**: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
   a. Field Offices: Class A stored-pressure water-type extinguishers.
   b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
   c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-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.
7. 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.

3.5 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. Protect from damage caused by freezing temperatures and similar elements.
   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.
   2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. **Temporary Facility Changeover**: Except for using permanent fire protection as soon as available, 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 the property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary paving not intended for or acceptable for integration into permanent paving. 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, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. **Related Sections** include the following:
1. Section 01 1900 "**Definitions and Standards**" for applicable industry standards for products specified.
2. Section 01 7700 "**Closeout Procedures**" for submitting warranties for contract closeout.
3. **Divisions 2** through **48 Sections** for specific requirements for **warranties** on products and installations specified to be warranted.

1.3 DEFINITIONS

A. **Products**: Items purchased 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, which is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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. **Substitutions**: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. **Basis-of-Design Product Specification**: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named or unnamed manufacturers.

D. **Manufacturer's Warranty**: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. **Special Warranty**: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

A. **Product List**: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordination: Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.
      g. Projected delivery date or time span of delivery period.
      h. Identification of items that require early submittal approval for scheduled delivery date.
   3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
      a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
   4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

B. **Substitution Requests**: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. 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 one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 business days of receipt of request, or 7 business days of receipt of additional information or documentation, whichever is later.
   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. **Basis-of-Design Product Specification Submittal**: Comply with requirements in Division 1 Section "Submittals." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. **Compatibility of Options**: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be 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.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.7 PRODUCT WARRANTIES

A. **General**: Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. **Special Warranties**: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Refer to Divisions 2 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

C. **Submittal Time**: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. **General Product Requirements**: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that 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 not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. **Product Selection Procedures**: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
   a. Substitutions may be considered, unless otherwise indicated.
2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.
3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named (or unnamed) manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
    a. Substitutions may be considered, unless otherwise indicated.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. **Timing**: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. **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:
1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.

5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. 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.

2.3 COMPARABLE PRODUCTS

A. **Where products** or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 7300

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** general procedural requirements governing **execution of the Work** including, but not limited to, the following:
   1. Construction layout.
   2. General installation of products.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of the Work.

B. **Related Sections** include the following:
   1. Section 01 3100 "**Project Management and Coordination**" for procedures for coordinating field engineering with other construction activities.
   2. Section 01 3300 "**Submittals**" for administrative submittals and also product and procedural submittals.
   3. Section 01 7700 "**Closeout Procedures**" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. **Existing Utilities**: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. **Acceptance of Conditions**: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. **Existing Utility Interruptions**: Do not interrupt utilities serving facilities occupied unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than two business days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's and Owner's written permission.

B. **Field Measurements**: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. **Space Requirements**: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. **Review of Contract Documents and Field Conditions**: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. **Verification**: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

3.4 FIELD ENGINEERING

A. **Identification**: Owner will identify existing benchmarks, control points, and property corners.

B. **Reference Points**: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

3.5 INSTALLATION

A. **General**: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   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 as indicated in spaces without a suspended ceiling.

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. **Anchors and Fasteners**: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.

G. **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.

H. **Hazardous Materials**: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. **General**: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. **Site**: Maintain Project site 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 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.

E. **Concealed Spaces**: Remove debris from concealed spaces before enclosing the space.

F. **Exposed Surfaces**: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. **Cutting and Patching**: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
   1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. **Waste Disposal**: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. **Protection**: 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.

J. **Maintenance**: 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 smooth operation without damaging effects.

K. **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.

3.7 DUST CONTROL

A. **Provide continuous** (7 days per week, 24 hours per day) fugitive dust control measures within the limits of the construction site, related sites and adjacent streets and roads. Dust control shall be provided for, but not be specifically limited to, the stabilization of unpaved roads, haul roads, access roads, spoil sites, borrow and material sources, excavations, embankments, stockpiles, and all other areas which become potential sources of dust as a result of construction activities.

B. **Maintain compliance with the General Utah Air Pollution Regulations**, R446 - Utah Air Conservation Regulations, Section 4.5, Fugitive Emissions, applicable County Air Pollution Control Ordinances, and as directed by the Architect. Dust control measures shall include but not be limited to the following:
   1. Wetting of surfaces with water as appropriate.
   2. Minimizing surface disturbances.

C. **In order to control fugitive dust emissions**, apply the following procedures and techniques:
   1. Cover loads of materials, debris and waste materials taken from construction sites as needed to suppress dust during transit.
   2. Water down or apply other approved dust control measures to the construction site, haul roads and public access roads as needed to suppress dust.
   3. All mud and dirt shall be removed from vehicles prior to entering a paved or graveled area or road. Any mud or dirt that is carried out onto paved or graveled surfaces shall be removed from surfaces immediately and no less than daily.

3.8 STARTING AND ADJUSTING

A. **Start equipment** and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. **Adjust operating components** for proper operation without binding. Adjust equipment for proper operation.

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

D. **Manufacturer's Field Service**: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 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. **Comply with manufacturer's written instructions** for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. **Repair or remove** and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
   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

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Project Record Documents.
   3. Operation and maintenance manuals.
   4. Warranties.
   5. Instruction of Owner's personnel.
   6. Final cleaning.

B. **Related Sections** include the following:
   1. Section 01 2900 "**Payment Procedures**" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Section 01 7300 "**Execution Requirements**" for progress cleaning of Project site.
   3. Section 01 7820 "**Operation and Maintenance Data**" for operation and maintenance manual requirements.
   4. **Divisions 2 through 48** Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. **Preliminary Procedures**: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. **Inspection**: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. 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.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. **Preliminary Procedures**: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. **Inspection**: Submit a written request for final inspection for acceptance. 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.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

C. **Additional Review Fees**: Should Architect perform more than one additional review, or extend its construction period services more than 15 business days beyond the scheduled completion date, due to the failure of the Contractor's work to comply with the claims of status or completion made by the Contractor, Owner will compensate Architect for such additional/ extended services at the rate of $500.00 per day. The Owner shall then deduct the amount of such compensation from the final payment to the Contractor.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. **Preparation**: Submit three copies 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.

1.6 PROJECT RECORD DOCUMENTS

A. **General**: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. **Record Drawings**: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. 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 prepare the marked-up Record Prints.
    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. **Record Specifications**: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy 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. Note related Change Orders, Record Drawings, and Product Data, where applicable.

D. **Record Product Data**: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
   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 Drawings, and Record Specifications, where applicable.

E. **Miscellaneous Record Submittals**: 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.

1.7 OPERATION AND MAINTENANCE MANUALS

A. **Assemble a complete set of operation and maintenance data** indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
   1. Operation Data:
      a. Emergency instructions and procedures.
      b. System, subsystem, and equipment descriptions, including operating standards.
      c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
      d. Description of controls and sequence of operations.
      e. Piping diagrams.
   2. Maintenance Data:
      a. Manufacturer's information, including list of spare parts.
      b. Name, address, and telephone number of Installer or supplier.
      c. Maintenance procedures.
      d. Maintenance and service schedules for preventive and routine maintenance.
      e. Maintenance record forms.
      f. Sources of spare parts and maintenance materials.
      g. Copies of maintenance service agreements.
      h. Copies of warranties and bonds.

B. **Organize operation and maintenance manuals** into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

C. **Provide documentation** as outlined in Division 1 Section "General Commissioning Requirements" demonstrating systems are functioning per Contract Documents.

1.8 WARRANTIES

A. **Submittal Time**: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. **Organize warranty documents** into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch 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.

C. **Provide additional copies** of each warranty to include in operation and maintenance manuals.

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 DEMONSTRATION AND TRAINING

A. **Instruction**: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. **Program Structure**: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual

Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.
2. Review of documentation.
3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

A. **General**: Provide 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 the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    a. Clean Project 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 neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project 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; shampoo if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
        1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grilles.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. **Pest Control**: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. **Cleaning Standards**: Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

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DIVISION 02 – EXISTING CONDITIONS

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SECTION 02 4101

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Patch and repair material disturbed during construction including but not limited to, walls, floors, ceilings, asphalt, concrete, lawns and landscaping, roofs, etc.

1.3 DEFINITION

A. **Cutting**: Removal of existing construction necessary to permit installation or performance of other Work.

B. **Patching**: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. **Cutting and Patching Proposal**: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed.
   1. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. **Structural Elements**: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. **Operational Elements**: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or which results in increased maintenance or decreased operational life or safety, including but not limited to the following:
   1. Primary operational systems and equipment.
   2. Fire-protection systems.
   3. Communication systems.
   4. Electrical wiring systems.

C. **Miscellaneous Elements**: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
1. Piping, ductwork, vessels, and equipment.

D. **Visual Requirements**: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.
1. If possible, retain original Installer or fabricator to cut and patch exposed Work. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

E. **Cutting and Patching Conference**: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. **Existing Warranties**: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **General**: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine surfaces** to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Temporary Support**: Provide temporary support of Work to be cut.

B. **Protection**: Protect existing 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.

C. **Adjoining Areas**: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. **Existing Services**: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

A. **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 existing 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. **Cutting**: Cut existing 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. General: Use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Roofing: Open no more roof area than necessary to accommodate new curbs and penetrations. Protect openings and restore to weather-tightness at the end of each working day or when threatening weather is predicted.
6. Patching: Proceed with patching after construction operations requiring cutting are complete.

C. **Patching**: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Patch masonry with masonry units and grout that match as closely as possible the original. Flash and repair roof to water- and weather-tight construction using materials compatible with roofing system. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION

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SECTION 02 4102

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
1. Demolition and removal of selected portions of a building or structure.
2. Demolition and removal of selected site elements.
3. Repair procedures for selective demolition operations.

B. **Related Sections** include the following:
1. Section 02 1401 "**Cutting and Patching**" for cutting and patching procedures for selective demolition operations.
2. **Divisions 22 and 23** Sections for demolishing, cutting, patching, or relocating mechanical items.
3. **Division 26** Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. **Remove**: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. **Remove and Salvage**: Detach items from existing construction and deliver them to Owner ready for reuse.

C. **Remove and Reinstall**: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. **Existing to Remain**: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 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 during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. **Proposed Dust-Control and Noise-Control Measures**: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. **Schedule of Selective Demolition Activities**: Indicate the following:
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.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary partitions and means of egress.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. **Inventory**: After selective demolition is complete, submit a list of items that have been removed and salvaged.

E. **Pre-demolition Photographs or Videotape**: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

F. **Landfill Records**: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. **Demolition Firm Qualifications**: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. **Regulatory Requirements**: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. **Standards**: Comply with ANSI A10.6 and NFPA 241.

D. **Pre-demolition Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
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.

1.7 PROJECT CONDITIONS

A. **Owner will occupy portions of building** immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. **Maintain access to existing walkways**, corridors, and other adjacent occupied or used facilities.
1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. **Owner assumes no responsibility for condition of areas** to be selectively demolished.
1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. **Hazardous Materials**: Due to the age and character of existing building, it is assumed that hazardous materials will be encountered in the Work.
1. Hazardous materials will be removed by Owner before start of the Work or removal will be coordinated with the Contractor during the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. **Storage or sale of removed items** or materials on-site will not be permitted.

F. **Utility Service**: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. **Use repair materials** identical to existing materials.
1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
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** that utilities have been disconnected and capped.

B. **Survey existing conditions** and correlate with requirements indicated to determine extent of selective demolition required.

C. **Inventory and record** the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. **When unanticipated mechanical, electrical, or structural elements** that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. **Engage a professional engineer** to survey 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 demolition operations.

F. **Perform surveys** as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. **Existing Utilities**: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. **Utility Interruption**: Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

C. **Provide at least 72 hours'** notice to Owner if shutdown of service is required during changeover.

D. **Utility Requirements**: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

E. **Owner will arrange to shut off indicated utilities** when requested by Contractor.

F. **If utility services are required to be removed**, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

G. **Cut off pipe or conduit in walls** or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

H. **Utility Requirements**: Refer to Division 22, 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. **Dangerous Materials**: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. **Pest Control**: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

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.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.
4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

D. **Temporary Facilities**: Provide temporary barricades and other 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.
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.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

E. **Temporary Enclosures**: Provide temporary enclosures for protection of existing building and 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 not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

F. **Temporary Partitions**: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

G. **Temporary Shoring**: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction 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.

3.4 POLLUTION CONTROLS

A. **Dust Control**: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
   2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. **Disposal**: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. **Cleaning**: 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.

3.5 SELECTIVE DEMOLITION

A. **General**: Demolish and remove existing construction only 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, to minimize disturbance of adjacent surfaces. 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 adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. **Existing Facilities**: Comply with Owner's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. **Removed and Salvaged Items**: Comply with the following:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify 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.

D. **Removed and Reinstalled Items**: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify 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. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
    a. Removed and reinstalled items include, but are not limited to: Overhead sectional doors.

E. **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 their original locations after selective demolition operations are complete.

F. **Concrete**: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

G. **Masonry**: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

H. **Concrete Slabs-on-Grade**: Saw-cut perimeter of area to be demolished, then break up and remove.

I. **Resilient Floor Coverings**: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

J. **Remove residual adhesive** and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

K. **Roofing**: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Division 7 Section for new roofing requirements.

L. **Air-Conditioning Equipment**: Remove equipment without releasing refrigerants.

3.6 PATCHING AND REPAIRS

A. **General**: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. **Repairs**: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved 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 Walls**: Where walls or partitions that 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.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. **General**: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. **Burning**: Do not burn demolished materials.

C. **Disposal**: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

DIVISION 03 – CONCRETE

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SECTION 03 3313

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. **Section includes** cast-in-place concrete, formwork, reinforcement, and accessories.
   1. Cast-in-place concrete used structurally including but not limited to:
      a. Slabs on grade.
      b. Walls.
   2. Formwork.
   3. Reinforcement.
      a. Reinforcing Bars.
      b. Steel Wire.
   4. Sealed/hardened concrete floor finish.
   5. Accessories:
      a. Under Slab Vapor Barrier.

B. **Grout-cleaned or plastered finishes** shall not be permitted or accepted.

1.3 SUBMITTALS

A. **Product Data**: Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, sealer/hardener materials, and others as requested by Architect.

B. **Shop Drawings; Reinforcement**: Submit original shop drawings prepared by a registered Professional Engineer for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. **Architect's review** is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility.

D. **Samples**: Submit samples of materials as requested by Architect, including names, sources, and descriptions.

E. **Laboratory Test Reports**: Submit laboratory test reports for concrete materials and mix design test.

F. **Materials Certificates**: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.4 QUALITY ASSURANCE

A. **Codes and Standards**: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. ACI 301 "Specifications for Structural Concrete for Buildings".
   2. ACI 318 "Building Code Requirements for Reinforced Concrete".
   3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

B. **Testing Agency**: Owner will employ and pay a qualified independent testing agency to perform field quality-control testing services specified in Part 3 of this section. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

1.5 QUALITY ASSURANCE FOR SPECIAL CONCRETE FLOOR FINISHES

A. **Installer Qualifications**:
   1. Use an experienced installer and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
   2. The special concrete finish manufacturer for each specified material and process shall certify applicator.
   3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section

B. **Manufacturer's Certification**: Provide letter of certification from concrete finish manufacturer or specialized applicator stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and installation requirements required by the manufacturer

C. **Mockups** for Concrete Floor Finishes:
   1. At locations selected by the Architect, prepare up to four (4) mockups 4 by 4 feet for review and approval.
   2. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in mockup panels.
   3. Mockup shall be sealed by the individual workers who will actually be performing the work for the Project.
   4. Obtain written approval of the mockup from Architect before start of work.
   5. Retain approved mockup through completion of the work for use as a quality standard for finished work.
   6. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

D. **Protection**: NO satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. PREVENTION IS THEREFORE ESSENTIAL
   1. Diaper hydraulic powered equipment to avoid staining of the concrete.
   2. Do not park vehicles on the inside slab. If necessary to complete work, place drop cloths under vehicles at all times.
   3. Do not use pipe cutting machine on the inside floor slab.
   4. Do not place steel on interior slab to avoid rust staining.

E. **Pre-Installation Conference**: Conduct conference at project site to comply with requirements in Division 1 Section "Project Management and Coordination".

F. **Delivery, Storage and Handling**:
1. Deliver materials in original packages and containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage, mixing with other components, and application.
2. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.
3. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers

1.6 PROJECT CONDITIONS

A. **Protection of Footings against Freezing**: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.

B. **Surface Protection**: Protect adjacent finish materials against spatter during concrete placement.

1.7 PROJECT CONDITIONS FOR SPECIAL CONCRETE FLOOR FINISHES

A. **Environmental limitations**:
1. Comply with manufacturer’s written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
2. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before application of hardening/sealing agent can begin.
3. Application of hardening/sealing agent shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

1.8 WARRANTY ON SPECIAL CONCRETE FLOOR FINISHES

A. **Sealer/Hardener**: Manufacturer's and Certified Applicator's Joint Agreement for Twenty (20) year material warranty and Five (5) year labor warranty.

PART 2 - PRODUCTS

2.1 SPECIAL CONCRETE FLOOR FINISHES

A. **Available Products**: Subject to compliance with requirements of Contract Documents, products which may be incorporated in the work include, but are not limited to, the following:
1. Retro-Plate 99, Advanced Floor Products, Inc.
2. Consolideck LS; Prosoco.
3. Liqui-Hard Ultra; W.R. Meadows, Inc.

B. **Performance Criteria:**
1. Abrasion Resistance: ASTM C779 - Up to 400% increase in abrasion resistance.
2. Impact Strength: ASTM C805 - 21% increase impact strength.
3. Ultra Violet Light and Water Spray: ASTM G23-81 - No adverse effect to ultra violet and water spray.
4. Co-efficient of Friction: ASTM 1028 - all levels of finish (up to 800 grit) shall exceed OSHA and ADA recommendations.
5. Reflectivity: 30 percent increase.

C. **Certified Applicators:**
1. Western States Waterproofing 801-829-0218.
2. Protech Coatings 801-281-9898.
3. Intermountain Concrete Polishing 208-941-2495
4. Finn-Wall Specialties 801-566-1008

D. **Related Materials:**
1. Neutralizing Agent: Tri-sodium Phosphate.
2. Water: Potable.

2.2 MATERIALS

A. **Forms**:
1. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
   a. Overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
2. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
4. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2 inches to surface.
   a. Provide ties which, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

B. **Reinforcing Materials**:
1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
2. Steel Wire: ASTM A 82, plain, cold-drawn steel.
3. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Use wire bar type supports complying with CRSI specifications.
   a. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   b. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
4. Weldable Reinforcing Bars: ASTM A 706

C. **Concrete**:
1. Portland Cement: ASTM C 150, Type II, typical unless noted otherwise.
   a. Use one brand of cement throughout project, unless otherwise acceptable to Architect.
   b. Fly Ash: ASTM C 618, Class C or F.

c. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1) For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

2) Fine Aggregates shall comply with the following gradations:

Sieve	Percent passing
3/8 inch	100
No. 4	95 to 100
No. 16	50 to 85
No. 50	10 to 30
No. 100	2 to 10

3) Coarse Aggregates shall comply with the following gradations:

Sieve	Percent passing
1-1/2 inch	100
3/4 inch	90 to 100
3/8 inch	25 to 55
No. 4	0 to 10
No. 8	0 to 5
No. 200	Not to exceed 1.75 percent by weight in the combined coarse and fine aggregate.

4) Gradation limits: Maximum aggregate size shall not exceed the following requirements.

(a) 1/5 narrowest dimension between forms.

(b) 1/3 of depth of slabs.

(c) 3/4 of minimum clear spacing between reinforcing bars.

d. Water: Potable.

D. **Admixtures**:

1. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
2. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.
3. Super Plasticizer: ASTM C 494, Type F or Type G and containing not more than 0.1 percent chloride ions.
4. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.
5. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.
6. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.

E. **Accessories**:

1. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
2. Waterstops: Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as indicated. Size to suit joints.
   a. Rubber Waterstops: Corps of Engineers CRD-C 513.
   b. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.
3. Non-Shrink Grout: Grout shall be prepackaged, non-metallic, non-gaseous. It shall conform to ASTM C 1107 Grade B or C at a fluid, flow cone, consistency. Fluid grout shall attain 6500 psi compressive strength in 28 days.
4. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

5. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
   a. Waterproof paper.
   b. Polyethylene film.
   c. Polyethylene-coated burlap.
6. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309 Type 2 Class A for exterior.
7. Bonding Compound: Polyvinyl Acetate (interior only) shall conform to ASTM C 1059 Type 1. Acrylic or styrene butadiene shall conform to ASTM C 1059 Type II.
8. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
9. Evaporation Control**:** Monomolecular film designed to reduce rapid moisture loss during placement, float and finish operation.

F. **Under-Slab Vapor Barrier:**
1. Basis of Design: Contract Documents are based on product listed below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
   a. Manufacturer: Stego Industries, LLC.
   b. Product: Stego Wrap Vapor Barrier (15-mil).
2. Vapor Barrier Properties:
   a. Permeance of less than 0.01 Perms (grains/(ft2-hr-inHg) as tested in accordance with ASTM E 1745 Section 7.
   b. Other performance criteria:
      1) Strength: ASTM E 1745 Class A.
      2) Thickness: 15 mils minimum
3. Accessories
   a. Seam tape: By vapor barrier manufacturer.
   b. Vapor-proofing mastic: By vapor barrier manufacturer.

2.3 MIXES

A. **Proportioning and Design of Mixes**:
1. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
2. Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

B. **Design mixes** to provide normal weight concrete with a W/C ratio as indicated in ACI 318 or the General Notes.

C. **Adjustment to Concrete Mixes**: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

D. **Admixtures**:

1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in concrete as required for placement and workability.
2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
3. Use high-range water-reducing admixture in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.
4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content as indicated on the structural drawings.
    a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure:
        1) 4.5 percent (moderate exposure); 5.5 percent (severe exposure) 1 1/2 inch maximum aggregate. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1-inch maximum aggregate.
        2) 5.0 percent (moderate exposure); 6.0 percent (severe exposure) 3/4 inch maximum aggregate.
        3) 5.5 percent (moderate exposure); 7.0 percent (severe exposure) 1/2 inch maximum aggregate.
    b. Other Concrete (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
5. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
6. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
    a. Subjected to freezing and thawing; W/C 0.50.
    b. Subjected to deicers/watertight; W/C 0.45.
    c. Subjected to brackish water, salt spray, or deicers; W/C 0.40.
7. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as indicated on Structural Drawings.

E. **Concrete Mixing**:

1. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
    a. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
2. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

2.4 MIXES - SPECIAL REQUIREMENTS FOR FLOOR SLABS TO RECEIVE SPECIAL FINISH

A. **Provide the following requirements** for floor slabs to receive special finishes:
   1. Concrete design to be a minimum of 4000 psi.
   2. No more than 15 percent fly ash or slag to be used as cement replacement. Fly ash darkens concrete.
   3. Water/cement ratio to be in the area of 0.47.
   4. The addition of super plasticizers or water reducers is acceptable to achieve plasticity for placement.
   5. Air entrainment admixtures are not recommended. Total air entrainment, including cement, shall not exceed 5 percent.

PART 3 - EXECUTION

3.1 GENERAL

A. **Coordinate** the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

B. **Preparation**: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

C. **Installation Tolerances**:
   1. Slabs: Minimum Flatness FF of 30 and Minimum Levelness FL of 25.
   2. Slabs to Receive Special Finish: Minimum Flatness FF of 50 and Minimum Levelness FL of 35.
   3. Walls: Comply with ACI requirements for horizontal, vertical, and story to story tolerances.

3.2 ERECTION

A. **Forms**: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
   1. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
   2. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
   3. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

4. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
5. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
6. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
7. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.
8. Preparation of Form Surfaces:
    a. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
    b. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
    c. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
    d. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.3 INSTALLATION

A. **Reinforcement**: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
1. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.
2. Install under slab vapor barrier at all slab on grade applications.
    a. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.
        1) Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from expected direction of placement whenever possible.
        2) Extend vapor barrier over footings and grade beams to a distance acceptable to the Architect or stop at impediments such as dowels and waterstops.
        3) Seal vapor barrier to foundation wall or footing using manufacturer's tape or termination bar.
        4) Overlap joints 6 inches and seal with manufacturer's tape.
        5) Seal all penetrations (including pipes) per manufacturer's instructions.
        6) No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
        7) Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
4. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
5. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
6. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

B. **Concrete Placement**:
1. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
2. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
3. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
4. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
    a. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
    b. Do not vibrate forms or reinforcing steel.
6. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
    a. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
    b. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
    c. Maintain reinforcing in proper position during concrete placement operations.

7. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.1 and as herein specified.
   a. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F at point of placement.
   b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   c. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
8. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
   a. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
   b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
   c. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
   d. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

C. **Special Requirements** for Concrete Placement for Floor Slabs to Receive Special Concrete Finish.
   1. Cutting screeds are recommended to achieve a flat floor.
      a. Floor Flatness: FF50
      b. Floor Levelness: FL35

D. **Finish**:
   1. Rough Form Finish: Formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
   2. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
      a. Smooth Rubbed Finish: Provide smooth rubbed finish to concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.
         1) Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

E. **Slab Finishes**:

1. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
   a. After placing slabs, plane surface to tolerances for floor flatness (F) of 15 and floor levelness (F) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.
2. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
   a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both, Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F 18 - F 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
3. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
   a. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 20 - F 17. Grind smooth surface defects which would telegraph through applied floor covering system.
4. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
5. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. **Finishing** for Slabs to Receive Special Concrete Finish:

1. Finishing should be close to the surface, not burn and hard trowel or burn the surface finish.
2. Finish equipment for at least the final work should be equipped with pans. Plastic can be used, but care should be exercised not to burn the floor or leave plastic film.
3. Finish equipment should be run in a minimum of three directions (north/south; east/west; northeast/southeast) to prevent waves in the floor.
4. Care should be exercised to prevent "bird baths" and low spots.

G. **Joints**:

1. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.
2. Provide keyways at least 1-1/2 inch deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
3. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
4. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.
5. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
6. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch x 1/4 slab depth or inserts 1/4 inch wide x 1/4 of slab depth, unless otherwise indicated. Cut construction joints in concrete as soon as possible after concrete can take the weight of cutting machine, in order to allow cracks to occur at the contraction joint.
    a. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
    b. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
7. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).
8. Embedded Items:
    a. Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
    b. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
    c. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

H. **Miscellaneous Concrete**:

1. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

2. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.4 CURING AND PROTECTION

A. **General**: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
   2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. **Curing Methods**: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.
   1. Provide moisture curing by following methods.
      a. Keep concrete surface continuously wet by covering with water.
      b. Continuous water-fog spray.
      c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
   2. Provide moisture-cover curing as follows:
      a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:
      a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
      b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.
   4. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
   5. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
   6. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

C. **Curing for Slabs to Receive Special Concrete Finish**:

1. Several methods can be utilized. Consult with the Installer doing the concrete polishing. A chemical cure meeting ACI 309 will require a chemical removal. Use of curing blankets will require chemical cleaning. Minimum cure time per ACI recommendation is 7 days.
2. Water Cure: Use of blankets, Use blankets equal to 'UltraCure' as manufactured by 'McTech Group'. www.mctechgroup.com.
    a. Clean the surface immediately after the blankets are pulled up using a product equal to 'PreKlean' as manufactured by 'Consolidek'. It is recommended that the 'PreKlean' produce be applied and removed with an auto-scrubber.
    b. Disposal of removed material must comply with federal and local regulations.
3. Chemical Cure: Use of any ACI 309 cure material is acceptable.
    a. Removal of cure must be done chemically with a product equal to 'Consilideck Wax and Cure Remover' as manufactured by 'Prososo'. Material is to be applied to the surface by spray and allowed to dwell on the surface until the cure begins to break down. Run an auto-scrubber soft brushes applying water over the surface with several passes to agitate the cleaner. Remove with vacuum system on the auto-scrubber.
    b. Disposal of removed material must comply with federal and local regulations

3.5 INSTALLATION OF SPECIAL CONCRETE FLOOR FINISH

A. **Examination**:

1. Examine substrates, with certified applicator (installer) present, for conditions affecting performance of Sealer/Hardener Concrete Finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.
2. Do not begin installation until substrates have been properly prepared and the floor surfaces are free of construction latents and foreign contaminants that will inhibit penetration of Sealer/Hardener and performance.
3. If substrate preparation is the responsibility of another installer, notify Owner's Representative of unsatisfactory preparation before proceeding.

B. **Application of Special Concrete Floor Finish:**

1. Start any of the floor finish applications in presence of manufacturer's technical representative.
2. Apply concrete floor finish in accordance with manufacturer's instructions.
3. Stained Concrete Finish:
    a. Bring concrete substrate up to 800 grit.
    b. Apply acid stain, where indicated, in accordance with stain manufacturer's instructions.
    c. Cure stained surface in accordance with manufacturer's instructions.
    d. Neutralize stained concrete floor with neutralizing agent, and flush with water.
4. Sealing, Hardening and Polishing of Concrete Surface:
    a. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.
    b. Application is to take place at least 10 days prior to prior to installation of equipment and/or substantial completion.

c. Only a certified applicator shall apply Hardening/Sealing Agent. Applicable procedures must be followed as recommended by the product manufacturer and as required to match approved test sample.
d. Achieve waterproofing, hardening, dust-proofing, and abrasion resistance of the surface while imparting a sheen.
e. Apply special concrete sealer finish in accordance with sealer manufacturer's instructions.
f. Polish to required sheen levels.

C. **Field Quality Control**:
1. Manufacturer's Field Services: Manufacturer's representative must be available to provide technical assistance and guidance for surface preparation and application of Sealer/Hardener Concrete Finish.
2. Sealer/Hardener Concrete Finish shall be inspected and acceptable to the Architect or the Manufacturer of Sealer/Hardener Concrete Finish. Any area that is found unacceptable shall be repaired by the Certified Applicator as deemed necessary.

D. **Workmanship and Cleaning**:
1. Keep premises clean and free of debris at all times.
2. Touch-up and restore finish where damaged.
3. Remove spilled, splashed or splattered finish material from all surfaces, as required.
4. Do not mar surface finish or item being cleaned. Make necessary repairs to damaged surfaces caused by cleaning operation or installation of Sealer/Hardener Concrete Finish.
5. Remove debris from Jobsite. Dispose of materials in separate, closed, sealed containers in accordance with local regulations.

E. **Protection**:
1. Protect and prohibit traffic on Sealer/Hardener Concrete Finished Work according to manufacturer's instructions and recommendations.
2. Barricade areas to protect Ashford Formula spiff coat until properly cured for traffic according to manufacturer's instructions and recommendations.
3. Refer to Manufacturer for materials used to cover and protect the flooring surfaces. Do not apply any Tape to the floor as it will etch concrete surfaces.

3.6 REMOVAL OF FORMS

A. **Formwork not supporting weight of concrete**, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. **Formwork supporting weight of concrete**, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. **Form facing material** may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

D. **Re-Use of Forms**:

1. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
2. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.7 CONCRETE SURFACE REPAIRS

A. **Patching Defective Areas**: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
3. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
4. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
5. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
6. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
7. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
8. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

B. **Repair defective areas**, except random cracks and single holes not exceeding 1inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

1. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

C. **Perform structural repairs** with prior approval of Architect or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

3.8 FIELD QUALITY CONTROL

A. **Sampling and testing** for quality control during placement of concrete may include the following, as directed by Architect.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
    a. Slump: As indicated on the Structural Drawings.
    b. Air Content: As indicated on the Structural Drawings.
    c. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens made.
2. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
3. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and two specimens retained in reserve for later testing if required.
    a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When total quantity of a given class of concrete is less than 50 cubic yards, strength test may be waived by Architect if, in his judgment, adequate evidence of satisfactory strength is provided.
    c. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    d. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. **Report test results in writing to Architect**, Structural Engineer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

C. **Nondestructive Testing**: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. **Additional Tests**: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

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SECTION 03 3316

CAST-IN-PLACE ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section specifies** cast-in-place architectural concrete where architectural grade concrete is indicated on the Drawings, including:
   1. Formwork.
   2. Reinforcement accessories.
   3. Concrete materials.
   4. Concrete mix design.
   5. Placement procedures.
   6. Finishes.

B. **Related Sections** include the following:
   1. Section 03 3313 "**Cast-in-Place Concrete**" for structural and general cast-in-place concrete construction, including formed and unformed finishes.
   2. Section 07 9200 "**Joint Sealants**" for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 DEFINITION

A. **Cast-in-Place Architectural Concrete**: Concrete that is exposed to view on surfaces of the completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

1.4 SUBMITTALS

A. **Product Data**: For each type of manufactured material and product indicated.

B. **Design Mixes**: For each concrete mix. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. **Shop Drawings**: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie location and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.

D. **Samples**: For each of the following materials:
   1. Form-facing panel.
   2. Form-release agent.
   3. Form ties.

4. Cement.
5. Coarse- and fine-aggregate gradations.
6. Chamfers and rustications.
7. Curing compound.

E. **Material Test Reports**: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated, based on comprehensive testing of current materials:
1. Cementitious materials and aggregates.
2. Admixtures.
3. Curing compounds.

F. **Placement Schedule**: Submit concrete placement schedule before start of architectural concrete placement operations. Include location of all joints including construction joints.

G. **Minutes** of preinstallation conference.

1.5 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced cast-in-place architectural concrete contractor who has specialized in installing cast-in-place architectural concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. **Concrete Manufacturer Qualifications**: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. **ACI Standards**: Comply with ACI 303.1, "Specification for Cast-in-Place Architectural Concrete"; ACI 301, "Specification for Structural Concrete"; and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials," unless more stringent provisions are indicated.

D. **Sample Panels**: Before casting architectural concrete, produce sample panels to demonstrate the approved range of selections made under sample Submittals. Produce a minimum of 3 sets of full-scale sample panels, cast vertically, approximately 48 by 48 by 6 inches minimum, to demonstrate the expected range of finish, color, and texture variations.
1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Demonstrate methods of curing aggregate exposure, sealers, and coatings, as applicable.
3. In presence of Architect, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
4. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
5. Demolish and remove sample panels when directed.

F. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. **Form-Facing Panels for As-Cast Finishes**: Steel, glass-fiber-reinforced plastic, or other approved non-absorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. **Rustication Strips**: Metal, rigid plastic, or dressed wood with sides beveled and back kerfed; non-staining.

C. **Chamfer Strips**: Do not chamfer any edges except as specifically detailed.

D. **Chamfer Strips**: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; nonstaining.

E. **Form Joint Tape**: Compressible foam tape, pressure sensitive, AAMA 810.1, minimum 1/4 inch thick.

F. **Form Joint Sealant**: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS, which adheres to form joint substrates.

G. **Sealer**: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration from wood of set-retarding chemicals.

H. **Form-Release Agent**: Commercially formulated form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.

I. **Form Ties**: Factory-fabricated, internally disconnecting or removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter on concrete surface.

2.2 REINFORCEMENT ACCESSORIES

A. **General**: Comply with Division 3 Section "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

2.3 CONCRETE MATERIALS

A. **Portland Cement**: Refer to Division 3 Section "Cast-In-Place Concrete".

B. **Normal-Weight Coarse Aggregate**: Refer to Division 3 Section "Cast-In-Place Concrete".

C. **Water**: Potable, complying with ASTM C 94 except free of wash water from mixer washout operations.

D. **Chemical Admixtures**: Refer to Division 3 Section "Cast-In-Place Concrete".

2.4 CURING MATERIALS

A. **Clear, Waterborne, Liquid Membrane-Forming Curing Compound**: ASTM C 309, Type 1, Class B.

2.5 REPAIR MATERIALS

A. Refer to **Division 3** Section "Cast-In-Place Concrete".

2.6 CONCRETE MIXES

A. Refer to **Division 3** Section "Cast-In-Place Concrete".

2.7 CONCRETE MIXING

A. **Ready-Mixed Concrete**: Measure, batch, mix, and deliver cast-in-place architectural concrete according to ASTM C 94, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 90 to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. **General**: Comply with Division 3 Section "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

B. **In addition** to **ACI 303.1** limits on form-facing panel deflection, limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch.

C. **Fabricate forms** for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
   1. Do not use rust-stained, steel, form-facing material.

D. **Provide temporary openings** for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. **Chamfer exterior corners** and edges of cast-in-place architectural concrete where detailed or if not detailed chamfer edges as directed by the Architect.

F. **Coat contact surfaces** of wood rustications and chamfer strips with sealer before placing reinforcement.

G. **Form openings**, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. **Clean forms** and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. **Seal form joints** and penetrations at form ties with form joint tape or form joint sealant to prevent mortar leaks.

J. **Retighten forms** and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. **Coat contact surfaces** of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REINFORCEMENT AND INSERTS

A. **General**: Comply with Division 3 Section "Cast-in-Place Concrete" for fabricating and installing steel reinforcement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

A. **Formwork**, for sides of walls and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
   1. Schedule form removal to maintain surface appearance that matches approved sample panels.

B. **Clean and repair surfaces** of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

C. **When forms are reused**, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for architectural concrete surfaces.

3.4 JOINTS

A. **Construction Joints**: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
   2. Use bulkhead forms with keys of plywood, wood, or expanded galvanized steel sheet, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete. Align construction joint within rustications attached to form-facing material.

3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
4. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

B. **Contraction Joints**: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

A. **Before placing concrete**, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. **Do not add water** to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. **Deposit concrete continuously** between construction joints. Deposit concrete to avoid segregation.

D. **Deposit concrete** in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing concrete mix constituents to segregate.

E. **Cold-Weather Placement**: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise indicated and approved in concrete mix designs.

F. **Hot-Weather Placement**: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 FINISHES, GENERAL

A. **Architectural Concrete Finish**: Match sample panel.

B. **Related Unformed Surfaces**: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

C. **Maintain uniformity of special finishes** over construction joints, unless otherwise indicated.

3.7 AS-CAST FORMED FINISHES

A. **Smooth-Formed Finish**: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height. Do not apply rubbed finish to smooth-formed finish.

3.8 CONCRETE CURING

A. **Protect freshly placed concrete** from premature drying and excessive cold or hot temperatures according to ACI 301.

B. **Begin curing immediately** after removing forms from concrete. Cure by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
   1. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL

A. **General**: Comply with Division 3 Section "Concrete Work" for field quality-control requirements.

3.10 REPAIRS, PROTECTION, AND CLEANING

A. **Repair and cure** damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
   1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

B. **Protect corners**, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. **Protect cast-in-place architectural concrete** from staining, laitance, and contamination during remainder of construction period.

D. **Clean cast-in-place architectural concrete** surfaces after finish treatment to remove stains, markings, dust, and debris.

E. **Wash and rinse** surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
   1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

F. **Caulk joints** to protect against sand and temperature induced heaving.

END OF SECTION

DIVISION 04 – MASONRY

Section 04 2223 Unit Masonry Assemblies

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SECTION 04 2223

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMU).
   2. Mortar and grout.
   3. Reinforcing steel.
   4. Masonry joint reinforcement.
   5. Miscellaneous masonry accessories.

B. **Related Sections** include the following:
   1. Section 07 6200 "**Sheet Metal Flashing and Trim**" for exposed sheet metal flashing.

C. **Products installed, but not furnished**, under this Section include the following:
   1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."

1.3 DEFINITIONS

A. **Reinforced Masonry**: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. **Provide unit masonry** that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.
   1. For Concrete Unit Masonry: f'm = 2000 psi.

1.5 SUBMITTALS

A. **Product Data**: For each different masonry unit, accessory, and other manufactured product specified.

B. **Shop Drawings**: Show fabrication and installation details for the following:
   1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. **Material Test Reports**: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
   1. Each type of masonry unit required.
      a. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with proportion requirements of ASTM C 270.
3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

D. **Material Certificates**: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Each type of masonry unit required.
   a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
4. Each material and grade indicated for reinforcing bars.
5. Each type and size of joint reinforcement.
6. Each type and size of anchor, tie, and metal accessory.

E. **Cold-Weather Procedures**: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. **Testing Agency Qualifications**: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

B. **Source Limitations for Masonry Units**: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. **Source Limitations for Mortar Materials**: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. **Preconstruction Testing Service**: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Mortar Test: For mortar proportionper ASTM C 270.
3. Grout Test: For compressive strength per ASTM C 1019.

E. **Fire-Resistance Ratings**: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

F. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

G. **Mockups**: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockups in the locations indicated or, if not indicated, as directed by Architect.
2. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
    a. Each type of exposed unit masonry construction.
3. Clean exposed faces of mockups with masonry cleaner as indicated.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
8. Demolish and remove mockups when directed.
9. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. **Store masonry units** on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. **Store cementitious materials** on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. **Store aggregates** where grading and other required characteristics can be maintained and contamination avoided.

D. **Store masonry accessories**, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. **Protection of Masonry**: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work, except when the ambient temperature is expected to remain above 65 degrees F and no rain is forecast for the next 24 hours. (This is to prevent condensation from covered walls causing a moisture problem.) Cover partially completed masonry each day that construction is not in progress. Walls are to be protected until they are permanently protected by the roofing membrane over the cap plate. Provide temporary protection immediately following the topping out of each section of wall by installing waterproof sheeting over the cap plate until the roofing membrane is installed. A solid grouted top bond beam shall not be considered adequate protection for the wall.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Protection shall remain in place until final weatherproof covering has been installed. Once masonry work has commenced the Contractor shall reimburse the Owner the sum of $500.00 per day that the masonry work is not protected.

B. **Do not apply uniform floor or roof loads** for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. **Stain Prevention**: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
5. Provide temporary edge on floor slabs to prevent moisture from draining over the edge of the floor slabs and down walls

D. **Cold-Weather Requirements**: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements of TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. **Hot-Weather Requirements**: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
1. When ambient temperature exceeds 100 degrees F, or 90 degrees F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. **Defective Units**: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS

A. **General**: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. At interior walls, provide chamfered units for outside corners, unless otherwise indicated.

B. **Concrete Masonry Units**: ASTM C 90-00 and as follows (standard units)
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
   2. Weight Classification: Medium weight. (Minimum weight of 125 lbs per cu. ft.)
   3. Size (Width): Manufactured to the following dimensions:
      a. 6 inches nominal, 5 5/8 inches actual.
      b. 8 inches nominal; 7-5/8 inches actual.
      c. 10 inches nominal; 9-5/8 inches actual.
      d. 12 inches nominal; 11-5/8 inches actual.
   4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
      a. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

A. **Portland Cement**: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. **Hydrated Lime**: ASTM C 207**,** Type S.

C. **Aggregate for Mortar**: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

D. **Aggregate for Grout**: ASTM C 404.

E. **Mortar Pigments**: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Provide multiple colors as selected by the Architect. Locate each color where directed by the Architect.

F. **Epoxy Pointing Mortar**: ASTM C 395, epoxy resin based material formulated for use as pointing mortar for structural clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors

G. **Water**: Potable.

2.4 REINFORCING STEEL

A. **Uncoated Steel Reinforcing Bars**: ASTM A 615 Grade 60.

2.5 MASONRY JOINT REINFORCEMENT

A. **General**: ASTM A 951 and as follows:
   1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
   2. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
   3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
   4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. **For single-wythe masonry**, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

2.6 MISCELLANEOUS ANCHORS

A. **Anchor Bolts**: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
   1. Non-headed bolts, bent in manner indicated.

B. **Post-installed Anchors**: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Type: Expansion anchors.
   2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
   3. For Post-installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
   4. For Post-installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. **Compressible Filler**: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. **Preformed Control-Joint Gaskets**: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
   1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

C. **Bond-Breaker Strips**: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.8 MASONRY CLEANERS

A. **Job-Mixed Detergent Solution**: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gallon of water.

2.9 MORTAR AND GROUT MIXES

A. **General**: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout. Delete subparagraph below if cold-weather admixture is not retained.

B. **Mortar for Unit Masonry**: Comply with ASTM C 270, Proportion Specification, as indicated on the structural drawings.

C. **Pigmented Mortar**: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:
   1. For mineral-oxide pigments and Portland cement-lime mortar, not more than 10 percent.

D. **Grout for Unit Masonry**: Comply with ASTM C 476, type as indicated on the structural drawings.

E. **Epoxy Pointing Mortar**: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

2.10 SOURCE QUALITY CONTROL

A. **Owner will engage** a qualified independent testing agency to perform source quality-control testing indicated below:
   1. Payment for these services will be made by Owner.
   2. Re-testing of materials failing to meet specified requirements shall be done at Contractor's expense.

B. **Concrete Masonry Unit Tests**: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine conditions**, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   2. Verify that substrates are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. **Before installation**, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. **Thickness**: Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. **Build chases** and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. **Leave openings** for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. **Cut masonry units** with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. **Select and arrange units** for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

F. **Wetting of Masonry**: Wet masonry before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. **Comply** with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. **Lay out walls** in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. **Bond Pattern for Exposed Masonry**: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
   1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. **Lay concealed masonry** with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. **Stopping and Resuming Work**: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. **Built-in Work**: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. **Fill space** between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. **Where built-in items are to be embedded** in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. **Fill cores** in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. **Build non-load-bearing** interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. At fire-rated partitions**,** install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. **Lay hollow masonry units as follows**:
   1. With full mortar coverage on horizontal and vertical face shells.
   2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
   3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. **Exterior Joints**: Tooled

3.6 MASONRY JOINT REINFORCEMENT

A. **General**: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. **Cut or interrupt joint reinforcement** at control and expansion joints, unless otherwise indicated.

C. **Provide continuity at corners** and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. **General**: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. **Form control joints in concrete masonry as follows**:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

C. **Build in horizontal, pressure-relieving joints** where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.8 LINTELS

A. **Install steel lintels** where indicated.

B. **Provide minimum bearing of 8 inches** at each jamb, unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, AND VENTS

A. **General**: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. **Prepare masonry surfaces** so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. **Install flashing as follows**:
   1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches, and behind air-infiltration barrier or building paper.
   2. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
   3. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.

D. **Install weeps** in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
   1. Use multi-cell vents to form weeps.
   2. Space weep holes 32 inches o.c.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. **Temporary Formwork and Shores**: Construct formwork and shores to support reinforced masonry elements during construction.
   1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. **Placing Reinforcement**: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

C. **Grouting**: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
   1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

A. **Owner will engage a qualified independent testing agency** to perform field quality-control testing indicated below.
   1. Payment for these services will be made by Owner.
   2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. **Testing Frequency**: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

C. **Mortar properties** will be tested per ASTM C 780. Test mortar for mortar air content, water-repellent admixture and compressive strength.

D. **Grout** will be sampled and tested for compressive strength per ASTM C 1019.

E. **Concrete Masonry Unit Tests**: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

3.12 REPAIRING, POINTING, AND CLEANING

A. **Remove and replace masonry units** that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. **Pointing**: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. **In-Progress Cleaning**: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. **Final Cleaning**: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
   5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.13 MASONRY WASTE DISPOSAL

A. **Excess Masonry Waste**: Remove excess masonry waste and legally dispose of off Owner's property.

END OF SECTION

DIVISION 05 - METALS

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SECTION 05 1216

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Extent of structural steel work** is shown on Drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. **Related Sections:**
1. Section 05 3100 "**Steel Decking**" for field installation of shear connectors through deck.
2. Section 05 5000 "**Metal Fabrications**" for miscellaneous steel fabrications and other metal items not defined as structural steel.

C. **Definitions:**
1. Structural Steel: Elements of structural-steel frame, as classified by American Institute of Steel Construction (AISC) 303, "Code of Standard Practice for Steel Buildings and Bridges" and as otherwise shown on drawings.
2. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS",”MOMENT FRAME” or along grid lines designated with "§" on Drawings, including columns, beams, and braces and their connections.
3. Heavy Sections: Rolled and built-up sections as follows:
   a. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.

   c. Column base plates thicker than 2 inches.
4. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
5. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings

1.3 SUBMITTALS

A. **Product Data**: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. High-strength bolts (each type), including nuts and washers.
2. Structural steel primer paint.
3. Shrinkage-resistant grout.

B. **Shop Drawings**: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
   1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
      a. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.

C. **Test Reports**: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

D. **Surveys**: Submit certified copies of each survey conducted by a registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.

1.4 QUALITY ASSURANCE

A. **Source Quality Control**: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
   1. Promptly remove and replace materials or fabricated components which do not comply.

B. **Fabricator Qualifications**: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
   1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
      a. Category: Category Cbd, complex steel building structures.
   2. Fabricators without AISC Certification shall provide special inspectors and conduct special inspections as required by authorities having jurisdiction.
   3. Other Certifications, other than AISC, may be acceptable but must be submitted and approved by authorities having jurisdiction prior to fabrication of any steel.

C. **Design of Members and Connections**: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

D. **Promptly notify Architect** whenever design of members and connections for any portion of structure are not clearly indicated.

E. **Codes and Standards:**
   1. Comply with provisions of following, except as otherwise indicated:
      a. AISC 303 - 2016 "Code of Standard Practice for Steel Buildings and Bridges", excluding the following: Section 1.5.2, Section 3.3 (last sentence of paragraph), Section 4.4, Section 4.4.1, Section 4.4.2, Section 4.5, Section 7.5.4, and Section 7.11.5, and Section 7.13.3.
   2. AISC 360 - 2016 "Specification for Structural Steel Buildings", including "Commentary" and Supplements thereto as issued.

3. AISC 341 - 2016 "Seismic Provisions of Structural Steel Buildings"
4. AISC/RCSC 2014 "Specification for Structural Joints using ASTM A325 or A490 Bolts" prepared by the Research Council on Structural Connections.
5. American Welding Society (AWS) D1.1 - 2011 "Structural Welding Code - Steel".
6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

F. **Qualifications for Welding Work**: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within the last 12 months.
2. If recertification of welders is required, retesting will be Contractor's responsibility.

1.5 DELIVERY, STORAGE AND HANDLING

A. **Deliver materials to site** at such intervals to ensure uninterrupted progress of work.
1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

B. **Store materials to permit easy access** for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

C. **Store fasteners in a protected place** in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication

1.6 COORDINATION

A. **Coordinate selection of shop primers** with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another. Note requirements for intumescent and other fireproofing coatings, in particular.

B. **Coordinate installation of anchorage items** to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Metal Surfaces, General**: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. **Wide Flange Structural Steel Shapes**: ASTM A 992, Grade 50 enhanced.
   1. Other Structural Steel Shapes, Plates and Bars: ASTM A 36, unless noted otherwise on the Structural Drawings.

C. **Hollow Structural Sections (HSS)**: ASTM A 500, Grade B.

D. **Hot-Formed Steel Tubing**: ASTM A 501.
   1. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501.
      a. Finish: Black, except where indicated to be galvanized.

E. **Steel Castings**: ASTM A 27, Grade 65-35, medium-strength carbon steel.

F. **Anchor Bolts**: ASTM A 307, headed type unless otherwise indicated.

G. **Unfinished Threaded Fasteners**: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
   1. Provide either hexagonal or square, heads and nuts, except use only hexagonal units for exposed connections.

H. **High-Strength Threaded Fasteners**: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
   1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
   2. Direct tension indicator washers may be used at Contractor's option.

I. **Electrodes for Welding**: Comply with AWS requirements.

J. **Structural Steel Primer Paint**: SSPC - Paint 13. Interior structural steel to receive application of spray-applied fireproofing or intumescent coatings shall be free of primer and paint coatings.

K. **Cement Grout**: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

M. **Nonmetallic, Shrinkage-Resistant Grout**: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide one of the following products. If not listed, submit as a substitution according to the Conditions of the Contract and Division 1 Sections.
      a. Euclid Chemical Co.; NS Grout; www.euclidchemical.com
      b. BASF Corporation; Masterflow 713; www.buildingsystems.basf.com
      c. Five Star Products, Inc.; Five Star Grout; www.fivestarproducts.com

2.2 FABRICATION

A. **Shop Fabrication and Assembly**: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
   1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
3. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   a. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
4. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

B. **Connections**: Weld or bolt shop connections, as indicated.
1. Bolt field connections, except where welded connections or other connections are indicated.
   a. Joint Type: Snug tightened unless indicated otherwise on Drawings.
2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
3. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

C. **High-Strength Bolted Construction:** Install high-strength threaded fasteners in accordance with AISC/RCSC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts".

D. **Welded Construction:** Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

E. **Shear Connectors**: Prepare steel surfaces as recommended by manufacturer of shear connectors. Where possible shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.3 SHOP PAINTING

A. **General:** Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar or to receive application of spray applied fireproofing or intumescent coating. Paint embedded steel which is partially exposed on exposed portions and initial 2 inches of embedded areas only.

B. **Non-painted Areas:** Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

C. **Inaccessible Surfaces**: Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. **Surface Preparation**: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
1. SP-1 "Solvent Cleaning".
2. At all exposed exterior steel and exposed interior steel prepare surface in accordance with commercial blast cleaning SSPC-SP6 with median surface profile of 1.5 to 2.0 mils.

E. **Painting**: Provide a one-coat shop applied paint system complying with Steel Structures Painting Council (SSPC)-Paint System Guide No. 7.00. Refer to Section 09 9123, "Painting", for specific primer required on identified steel items.

PART 3 - EXECUTION

3.1 PREPARATION

A. **Surveys:** Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

3.2 ERECTION

A. **Temporary Shoring and Bracing:** Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Do not shore cambered steel beams unless otherwise indicated on drawings.
1. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

B. **Setting Bases and Bearing Plates**: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

C. **Adjustments:** Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Install high strength washers under nuts at all anchor bolts.

D. **Grouting:** Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
1. Comply with manufacturer's instructions.

E. **Field Assembly**: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure within specified AISC tolerances.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
3. Splice members only where indicated and accepted on shop drawings.

F. **Erection Bolts**: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

G. **Field Adjustments**: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
1. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

H. **Thermal Cutting**: Do not use thermal cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

I. **Touch-Up Painting**: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.3 QUALITY CONTROL

A. **Testing Agency**: Owner will employ and pay a qualified independent testing agency to perform field quality-control testing services specified in this section.

B. **Testing agency shall conduct and interpret tests** and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

C. **Provide access for testing agency** to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. **Testing agency may inspect structural steel at plant** before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

E. **Correct deficiencies** in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

F. **Shop Bolted Connections:** Inspect or test in accordance with AISC specifications.

G. **Shop Welding:** Inspect and test during fabrication of structural steel assemblies, as follows:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.
    a. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
    b. Ultrasonic Inspection: ASTM E 164.
4. Inspection of shop welding is not required if the fabricator complies with 2018 IBC.

H. **Field Bolted Connections:** Inspect in accordance with 2018 IBC per AISC 360 "Specification for Structural Steel Buildings".

I. **Field Welding**: Inspect and test during erection of structural steel as follows:
   1. Comply with 2018 IBC.
   2. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   3. Perform visual inspection of all welds.

3.4 CLEANUP

A. Refer to **Division** 1 Section "**Execution Requirements**".

END OF SECTION

SECTION 05 3100

STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
   1. Roof deck.

B. **Related Sections** include the following:
   1. Section 05 1200 "**Structural Steel**" for shop-welded shear connectors.
   2. Section 05 5000 "**Metal Fabrications**" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. **Product Data**: For each type of deck, accessory, and product indicated.

B. **Shop Drawings**: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. **Product Certificates**: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. **Welding Certificates**: Copies of certificates for welding procedures and personnel.

E. **Product Test Reports**: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
   1. Mechanical fasteners.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. **Welding**: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

C. **AISI Specifications**: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

E. **FM Listing**: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Protect steel deck** from corrosion, deformation, and other damage during delivery, storage and handling.

B. **Stack steel deck** on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. **AISI Specifications:** Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ASC Steel Deck.; an ASC Profiles company.
2. Canam Group, Inc.
3. Metal Dek Group, a unit of Consolidated Systems Inc.
4. Nucor Corporation.
5. Roof Deck, Inc.
6. Verco Decking, Inc., a Nucor company.

2.3 ROOF DECK

A. **Steel Roof Deck**: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and the following:
1. Galvanized Steel Sheet: ASTM A653 or A1063, Grade 50 with G60 galvanized coating.
2. Deck Profile: Type WR, wide rib and Type NR, narrow rib and as indicated on the Structural Drawings.
3. Profile Depth: 1 1/2 inches and 3 inches and as indicated on the Structural Drawings.
4. Design Uncoated-Steel Thickness: Per plan.
5. Span Condition: Triple span or more as indicated.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.4 ACCESSORIES

A. **General**: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. **Mechanical Fasteners:** Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. **Side-Lap Fasteners**: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter. .
1. See General Structural Notes and structural drawings for other requirements.

D. **Flexible Closure Strips**: Vulcanized, closed-cell, synthetic rubber.

E. **Miscellaneous Sheet Metal Deck Accessories**: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

G. **Column Closures, End Closures, Z-Closures, and Cover Plates**: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. **Weld Washers:** Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. **Flat Sump Plates**: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. **Shear Connectors**: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

K. **Galvanizing Repair Paint**: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight

L. **Repair Paint**: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine supporting frame** and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. **Proceed with installation only after** unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. **Install deck panels** and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. **Install temporary shoring** before placing deck panels, if required to meet deflection limitations.

C. **Locate decking bundles** to prevent overloading of supporting members.

D. **Place deck panels** on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.

E. **Place deck panels flat** and square and fasten to supporting frame without warp or deflection.

F. **Cut and neatly fit deck panels** and accessories around openings and other work projecting through or adjacent to decking.

G. **Provide additional reinforcement** and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. **Comply with AWS requirements** and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. **Mechanical fasteners** may be used in lieu of welding to fasten deck in locations accepted and approved by the Architect. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF DECK INSTALLATION

A. **General**: Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows unless otherwise indicated on structural drawings:
   1. Weld Diameter: 3/4 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs at locations and spacings as indicated on the Drawings.

B. **Side-Lap and Perimeter Edge Fastening**: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on the Drawings.

C. **End Bearing**: Install deck ends over supporting frame with a minimum end bearing of 1 1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

D. **Roof Sump Pans and Sump Plates**: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.

E. **Miscellaneous Roof Deck Accessories**: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

F. **Flexible Closure Strips**: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. **Testing**: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. **Field welds** will be subject to inspection.

C. **Shear connector stud welds** will be inspected and tested according to AWS D1.1 for stud welding and as follows:
   1. Shear connector stud welds will be visually inspected.
   2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
   3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.

D. **Testing agency** will report test results promptly and in writing to Contractor and Architect.

E. **Remove and replace work** that does not comply with specified requirements.

F. **Additional testing and inspecting,** at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. **Galvanizing Repairs**: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. **Repair Painting**: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. **Provide final protection** and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following:
1. Steel ladders.
2. Loose bearing and leveling plates.
3. Loose steel lintels.
4. Shelf angles.
5. Steel framing and supports for countertops.
6. Steel framing and supports for mechanical and electrical equipment.
7. Steel framing and supports for applications where framing and supports are not specified in other Sections.
8. Miscellaneous metal trim.
9. Pipe bollards.
10. Pipe and tube guardrails.

B. **Related Sections** include the following:
1. Section 06 1000 "**Rough Carpentry**" for metal framing anchors and other rough hardware.

1.3 SUBMITTALS

A. **Product Data**: For the following:
1. Paint products.
2. Grout.

B. **Shop Drawings General**: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
1. Provide templates for anchors and bolts specified for installation under other Sections.

C. **Welding Certificates**: Copies of certificates for welding procedures and personnel.

D. **Qualification Data**: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. **Fabricator Qualifications**: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. **Welding**: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.2, "Structural Welding Code--Aluminum."
   3. AWS D1.3, "Structural Welding Code--Sheet Steel."
   4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PERFORMANCE REQUIREMENTS FOR HANDRAILS

A. **General**: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:
   1. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."
   2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. **Structural Performance of Handrails and Railings**: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:
   1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
      a. Concentrated load of 200 lbf applied at any point and in any direction.
      b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
   2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
      a. Concentrated load of 200 lbf applied at any point and in any direction.
      b. Uniform load of 50 lbf/ft. applied in any direction.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
   3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
      a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

C. **Thermal Movements**: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

D. **Control of Corrosion**: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.6 PROJECT CONDITIONS

A. **Field Measurements General**: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.7 COORDINATION

A. **Coordinate installation of anchorages for metal fabrications**. 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.

B. **Field Measurements for Handrails**: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. **Metal Surfaces, General**: For metal fabrications 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. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

2.2 FERROUS METALS

A. **Steel Plates, Shapes, and Bars**: ASTM A 36/A 36M.

B. **Steel Tubing**: Cold-formed steel tubing complying with ASTM A 500 Grade B.

C. **Steel Pipe**: ASTM A 53 Grade B, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. **Uncoated Hot-Rolled Steel Sheet**: Commercial quality, complying with ASTM A 569/A569M or structural quality, complying with ASTM A 570, Grade 30, unless another grade is required by design loads.

E. **Brackets, Flanges, and Anchors**: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

F. **Steel and Iron for Handrails**: Provide steel and iron in the form indicated, complying with the following requirements:
   1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
      a. Black finish, unless otherwise indicated.
      b. Galvanized finish for exterior installations and where indicated.
      c. Type F, or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.
   2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.

G. **Slotted Channel Framing**: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.
   1. Width of Channels: 1-5/8 inches.
   2. Depth of Channels: 1-5/8 inches.
   3. Metal and Thickness: Uncoated steel complying with ASTM A 570, Grade 33; 14 gauge minimum thickness.
   4. Finish: Rust-inhibitive, baked-on, acrylic enamel.

H. **Cast-in-Place Anchors in Concrete**: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

J. **Welding Rods and Bare Electrodes**: Select according to AWS specifications for metal alloy welded.

2.3 PAINT

A. **Shop Primer for Ferrous Metal**: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
   1. Refer to Section 09 9123 - Painting for specific primer required on identified steel items.

B. **Galvanizing Repair Paint**: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. **Bituminous Paint**: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FASTENERS

A. **General**: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. **Bolts and Nuts**: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. **Anchor Bolts**: ASTM F 1554, Grade 36.

D. **Machine Screws**: ASME B18.6.3.

E. **Lag Bolts**: ASME B18.2.1.

F. **Wood Screws**: Flat head, carbon steel, ASME B18.6.1.

G. **Plain Washers**: Round, carbon steel, ASME B18.22.1

H. **Lock Washers**: Helical, spring type, carbon steel, ASME B18.21.1.

I. **Expansion Anchors**: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

J. **Toggle Bolts**: FS FF-B-588, tumble-wing type, class and style as needed.

2.5 GROUT

A. **Nonshrink, Nonmetallic Grout**: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. **Shop Assembly**: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. **Shear and punch** metals cleanly and accurately. Remove burrs.

C. **Ease exposed edges** to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. **Weld corners** and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. **Provide for anchorage** of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. **Cut, reinforce, drill, and tap metal fabrications** as indicated to receive finish hardware, screws, and similar items.

G. **Fabricate joints** that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. **Allow for thermal movement** resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

I. **Form exposed work true to line** and level with accurate angles and surfaces and straight sharp edges.

J. **Remove sharp or rough areas** on exposed traffic surfaces.

K. **Form exposed connections with hairline joints**, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.7 STEEL LADDERS

A. **General**: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
   1. Comply with ANSI A14.3, unless otherwise indicated.
   2. For elevator pit ladders, comply with ASME A17.1.

B. **Siderails**: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.

C. **Bar Rungs**: 3/4-inch- diameter steel bars, spaced 12 inches o.c.

D. **Fit rungs in centerline of side rails**; plug-weld and grind smooth on outer rail faces.

E. **Support each ladder at top and bottom** and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

F. **Provide nonslip surfaces** on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

G. **Provide galvanized ladders**, including brackets and fasteners, at all exterior locations.

2.8 LOOSE BEARING AND LEVELING PLATES

A. **Provide loose bearing and leveling plates** for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. **Galvanize plates** after fabrication.

2.9 LOOSE STEEL LINTELS

A. **Fabricate loose structural-steel lintels** from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. **Weld adjoining members** together to form a single unit where as required.

C. **Size loose lintels** to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. **Galvanize loose steel lintels** located in exterior walls.

2.10 SHELF ANGLES

A. **Fabricate shelf angles** from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. **For cavity walls**, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

C. **Galvanize** shelf angles to be installed in exterior walls

D. **Furnish wedge-type concrete inserts**, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. **General**: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. **Fabricate units** from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Fabricate units from slotted channel framing where required for deflection.
   2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
   3. Furnish inserts if units must be installed after concrete is placed.

C. **Galvanize** miscellaneous framing and supports in the following locations:
   1. Exterior locations and where miscellaneous items will be concealed from view.

2.12 MISCELLANEOUS STEEL TRIM

A. **Unless otherwise indicated,** fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. **Provide cutouts, fittings, and anchorages as needed** to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. **Galvanize miscellaneous steel trim** in the following locations:
1. Exterior.

2.13 PIPE BOLLARDS

A. **Fabricate pipe bollards** from Schedule 40 steel pipe.

B. **Fabricate sleeves** for bollard anchorage from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve.

C. **Fabricate internal sleeves** for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 1/2-inch steel machine bolt.

D. **Equip bollards used at drive closures** with eye bolts to accommodate chains; color to match bollard.

2.14 FABRICATION - HANDRAILS

A. **General**: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. **Assemble handrails and railings in the shop** to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. **Form changes in direction of railing members as follows**:
1. By bending.
2. By radius bends of radius indicated.
3. By any method indicated above, applicable to change in direction involved.

D. **Form simple and compound curves** by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. **Welded Connections**: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. **Non-welded Connections**: Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive where this is manufacturer's standard splicing method.

G. **Brackets, Flanges, Fittings, and Anchors**: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

H. **Provide inserts** and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

I. **For railing posts set in concrete**, provide preset sleeves of steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, and steel plate forming bottom closure.

J. **For removable railing posts**, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
   1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

K. **Shear and punch metals cleanly and accurately**. Remove burrs from exposed cut edges.

L. **Ease exposed edges** to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

M. **Cut, reinforce, drill, and tap components,** as indicated, to receive finish hardware, screws, and similar items.

N. **Provide weep holes** or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.

O. **Fabricate joints** that will be exposed to weather in a watertight manner.

P. **Close exposed ends** of handrail and railing members with prefabricated end fittings.

Q. **Provide wall returns** at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

R. **Fillers**: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.15 FINISHES, GENERAL

A. **Comply with NAAMM's** "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. **Finish metal fabrications** after assembly.

2.16 STEEL AND IRON FINISHES

A. **Galvanizing**: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123, for galvanizing steel and iron products.
   2. ASTM A 153, for galvanizing steel and iron hardware.

B. **Preparation for Shop Priming**: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. **Application**: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. **Fastening to In-Place Construction**: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. **Cutting, Fitting, and Placement**: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. **Provide temporary bracing** or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. **Fit exposed connections accurately together to form hairline joints**. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. **Field Welding**: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. **Corrosion Protection**: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. **Clean concrete and masonry bearing surfaces** of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. **Set bearing and leveling plates** on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. **General**: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. **Support steel girders on solid grouted masonry**, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

3.4 INSTALLING PIPE BOLLARDS

A. **Anchor bollards in place with concrete footings**. Support and brace bollards in position in footing excavations until concrete has been placed and cured.

B. **Anchor internal sleeves for removable bollards** in place with concrete footings. Support and brace sleeves in position in footing excavations until concrete has been placed and cured.
   1. Place removable bollards over internal sleeves and secure with 1/2-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.
   2. Do not fill removable bollards with concrete.

C. **Fill bollards solidly** with concrete, mounding top surface.

3.5 INSTALLATION - HANDRAILS

A. **Fit exposed connections together** to form tight, hairline joints.

B. **Perform cutting, drilling, and** fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.
   1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. **Corrosion Protection**: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

D. **Adjust handrails and railings** before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

E. **Fastening to In-Place Construction**: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.6 RAILING CONNECTIONS

A. **Welded Connections**: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. **Expansion Joints**: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.7 ANCHORING POSTS FOR RAILINGS

A. **Cover anchorage joint** with flange of same metal as post, attached to post by set screws.

B. **Anchor posts** to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members by welding flanges to post and bolt to metal supporting surfaces.

3.8 ADJUSTING AND CLEANING

A. **Touchup Painting**: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. **Galvanized Surfaces**: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

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DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

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SECTION 06 1000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following:
1. Framing with dimension lumber.
2. Wood blocking and nailers.
3. Wood furring
4. Rooftop equipment bases and support curbs.
5. Plywood backing panels.

1.3 DEFINITIONS

A. **Rough Carpentry**: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. **Exposed Framing**: Dimension lumber not concealed by other construction.

C. **Lumber grading agencies**, and the abbreviations used to reference them, include the following:
1. NLGA - National Lumber Grades Authority.
2. WCLIB - West Coast Lumber Inspection Bureau.
3. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. **Product Data**: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. **Fastener Patterns**: Full-size templates for fasteners in exposed framing.

C. **Material Certificates**: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

D. **Research/Evaluation Reports**: For the following, showing compliance with building code in effect for Project:
   1. Wood-preservative-treated wood.
   2. Engineered wood products.
   3. Power-driven fasteners.
   4. Powder-actuated fasteners.
   5. Expansion anchors.
   6. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. **Source Limitations for Engineered Wood Products**: Obtain each type of engineered wood product through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Stack lumber, plywood, and other panels**; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. **Lumber**: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.
   5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. **Engineered Wood Products**: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. **Wood Structural Panels**:
   1. Plywood: DOC PS 1.
   2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
   4. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. **Preservative Treatment by Pressure Process**: AWPA C2 (lumber), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. **Kiln-dry material after treatment** to a maximum moisture content of 19 percent for lumber. Do not use material that is warped or does not comply with requirements for untreated material.

C. **Mark each treated item** with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. **Application**: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. **General:** Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Current Evaluation/Research Reports: Provide fire-retardant- treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.

B. **Interior Type A:** For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
   1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.

2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
3. No corrosion of metal fasteners results from their contact with treated wood.

C. **Inspection:** Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

D. **Acceptable Products**: Subject to compliance with requirements of Contract Documents, provide one of the following:
1. Interior Type A Fire-Retardant-Treated Wood:
   a. "Dricon" Lonza Wood Protection.
   b. "Pyro-Guard" Hoover Treated Wood Products.
   c. "FlamePRO" Koppers Performance Chemicals.
2. Exterior Type Fire-Retardant-Treated Wood:
   a. "Exterior Fire-X" Hoover Treated Wood Products.

2.4 DIMENSION LUMBER

A. **General**: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. **Joists, Rafters, and Other Framing Not Listed Above**: Construction or No. 2 grade and any of the following species:
1. Douglas fir-larch; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. **General**: Provide lumber for support or attachment of other construction, including the following:
1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Nailers.
4. Furring.
5. Grounds.

B. **For items of dimension lumber size**, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content and any of the following species:
1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
2. Western woods; WCLIB or WWPA.

C. **For concealed boards**, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Hem-fir or Hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
2. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. **For furring strips** for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. **Telephone and Electrical Equipment Backing Panels**: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.7 FASTENERS

A. **General**: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. **Nails, Brads, and Staples**: ASTM F 1667.

C. **Power-Driven Fasteners**: CABO NER-272.

D. **Wood Screws**: ASME B18.6.1.

2.8 METAL FRAMING ANCHORS

A. **General**: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
   1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
   2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. **Galvanized Steel Sheet**: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. **Set rough carpentry to required levels and lines**, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. **Do not use materials with defects** that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. **Apply field treatment** complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. **Securely attach rough carpentry work** to substrate by anchoring and fastening as indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. **Install where indicated and where required** for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. **Attach items to substrates to support applied loading**. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. **Provide permanent grounds** of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FRAMING INSTALLATION, GENERAL

A. **Framing Standard**: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. **Framing with Engineered Wood Products**: Install engineered wood products to comply with manufacturer's written instructions.

C. **Do not splice** structural members between supports.

D. **Beams or Girders**: As indicated on the Structural Drawings.

3.4 WOOD STRUCTURAL PANEL INSTALLATION

A. **General**: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

B. **Fastening Methods**: Fasten panels as indicated below:
   1. Sheathing:
      a. Nail to wood framing.
      b. Space panels 1/8 inch apart at edges and ends.
   2. Plywood Backing Panels: Nail to supports.

END OF SECTION

SECTION 06 1610

WOOD SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
1. Wall sheathing.
2. Plywood used in parapet construction.
3. Flexible flashing at openings in sheathing.

B. **Related Sections** include the following:
1. Section 05 4200 "**Cold Formed Metal Framing**" for framing for shear walls.
2. Section 06 1000 "**Rough Carpentry**" for plywood backing panels.
3. Section 06 2000 "**Finish Carpentry**" for interior plywood paneling.
4. Section 07 2613 "**Self-Adhering Air and Vapor Barrier**" for barrier system applied over sheathing.

1.3 SUBMITTALS

A. **Product Data:** For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 COORDINATION

A. **Coordinate flexible flashing system** with air and moisture barrier system. Verify compatibility of systems to assure a continuous, weathertight, air and moisture enclosure for entire building.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Stack plywood** and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. **Plywood:** Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. **Oriented Strand Board** (OSB): Either DOC PS 1 or DOC PS 2 - for use at structural shear walls.

C. **Thickness:** As needed to comply with requirements specified, but not less than thickness indicated.

D. **Factory mark** panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. **Preservative Treatment by Pressure Process**: AWPA C9.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. **Mark plywood** with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. **Application:** Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. **General**: Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Current Evaluation/Research Reports: Provide fire-retardant- treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.

B. **Interior Type A**: For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
   1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
   2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
   3. No corrosion of metal fasteners results from their contact with treated wood.

C. **Exterior Type**: Use for exterior locations and where indicated.

D. **Inspection**: Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

E. **Products**: Subject to compliance with requirements, provide one of the following:
1. Interior Type A Fire-Retardant-Treated Wood:
   a. "Dricon" Lonza Wood Protection.
   b. "Pyro-Guard" Hoover Treated Wood Products.
   c. "FlamePRO" Koppers Performance Chemicals.
2. Exterior Type Fire-Retardant-Treated Wood:
   a. "Exterior Fire-X" Hoover Treated Wood Products.

2.4 WALL SHEATHING

A. **Plywood Wall Sheathing**: Exterior rated conforming to PS 1 & PS 2 sheathing.
1. Span Rating: Not less than 16/0.
2. Nominal Thickness: As indicated on Architectural details, but not less than 1/2 inch.

B. **OSB Wall Sheathing:** Exterior rated conforming to PS 1 & PS 2 sheathing.
1. Span Rating: As indicated on the Structural Drawings.
2. Nominal Thickness: As indicated on the Structural Drawings.

2.5 ROOF CONSTRUCTION

A. **Plywood Roof/Parapet Blocking**: Exterior rated conforming to PS 1 & PS 2 sheathing.
1. Span Rating: As indicated on the Structural Drawings.
2. Nominal Thickness: As indicated on the Structural Drawings.

B. OSB Wall Sheathing: Exterior rated conforming to PS 1 & PS 2 sheathing.
1. Span Rating: As indicated on the Structural Drawings.
2. Nominal Thickness: As indicated on the Structural Drawings.

2.6 FASTENERS

A. **General:** Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. **Nails, Brads, and Staples**: ASTM F 1667.

C. **Power-Driven Fasteners**: NES NER-272.

D. **Wood Screws**: ASME B18.6.1.

2.7 MISCELLANEOUS MATERIALS

A. **Flexible Flashing**: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm).
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. GCP Applied Technologies, Inc.
      b. Polyguard Products, Inc.
      c. Protecto Wrap Company.
   2. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. **Do not use materials with defects** that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. **Cut panels at penetrations**, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. **Securely attach to substrate** by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. **Coordinate wall and roof sheathing** installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. **Do not bridge building expansion joints**; cut and space edges of panels to match spacing of structural support elements.

F. **Coordinate sheathing installation** with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. **General:** Comply with applicable recommendations in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
   1. Comply with "Code Plus" installation provisions in guide referenced in paragraph above.

B. **Fastening Methods:** Fasten panels as indicated below:
   1. Wall and Roof Sheathing:
      a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
      b. Space panels 1/8 inch apart at edges and ends.

3.3 FLEXIBLE FLASHING INSTALLATION

A. **Apply flexible flashing** where indicated to comply with manufacturers written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
   4. Lap weather-resistant building paper over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

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SECTION 06 2000

FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
1. Solid surface window sills.
2. Miscellaneous wood trim, including window framing, wall base, and other wood trims.
3. Plywood wall panels.

B. **Related Sections**:
1. Section 06 1000 "**Rough Carpentry**" for furring, blocking, and other carpentry work not exposed to view.
3. Section 09 2216 "**Non-Structural Metal Framing**" for installation of sheet metal strips coordinated with spacing of finish plywood panel fasteners.
4. Section 12 3200 "**Manufactured Cabinets and Casework**" for general casework and vanity tops.

1.3 SUBMITTALS

A. **Product Data**: Provide product data for each type of factory-fabricated product and process specified, including details of construction relative to materials, dimensions of individual components, profiles, textures, and colors.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: Engage an experienced Installer who has completed finish carpentry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Delivery and Storage**: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. **Environmental Conditions**: Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels through the remainder of construction period.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. **Lumber Standards**: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. **Inspection Agencies**: Inspection agencies, and the abbreviations used to reference them, include the following:
   1. NHLA - National Hardwood Lumber Association.
   2. RIS - Redwood Inspection Service.
   3. SPIB - Southern Pine Inspection Bureau.
   4. WCLIB - West Coast Lumber Inspection Bureau.
   5. WWPA - Western Wood Products Association.

C. **Grade Stamps**: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

2.2 INTERIOR STANDING AND RUNNING TRIM

A. **Softwood Trim**: Provide finished lumber and moldings complying with the following requirements including those of the grading agency listed with species:
   1. Species: Clear Pine; NLGA, WCLIB, or WWPA.
   2. Grade: B & Btr. Select or Supreme.
   3. Texture: Surfaced (smooth).
   4. Lumber for Transparent Finish (Stained or Clear): Solid lumber stock.

2.3 SOLID-SURFACING-MATERIAL

A. **Solid-Surfacing Material**: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.
   1. Available Products: Subject to compliance with requirements of Contract Documents, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Corian; DuPont Polymers.
      b. Solid Surfacing; Formica Corporation.
      c. Staron; Lotte Advanced Materials.

B. **Quality Standard**: Comply with NAAWS requirements for countertops.

C. **Grade**: Custom.

D. **Solid-Surfacing-Material Thickness**: 1/2 inch.

E. **Colors, Patterns, and Finishes**: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. Provide Architect's selections from manufacturer's full range of colors and finishes.

F. **Fabricate window sills** and wall caps in one piece with shop-applied edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Window sills and wall caps are to have a dropped edge as indicated on the drawings to cover raw edge of gypsum board.

G. **Fabricate counters** with shop-applied edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

2.4 PLYWOOD WALL PANELS

A. **Plywood:** APA A-D, Exposure 1, span rating not less than 24 inches on center; thickness as indicated on Drawings but not less than 1/2 inch; square edge; fully sanded face. No wax on exposed surface.

B. **Sizes and spacings as shown** on Drawings. Cut panels so that edges are clean and unchipped.

2.5 MISCELLANEOUS MATERIALS

A. **Fasteners for Interior Finish Carpentry**: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
   1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153.

B. **Glue**: **Aliphatic** or **phenolic-resin** wood glue recommended by manufacturer for general carpentry use.

2.6 FABRICATION

A. **Wood Moisture Content**: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry on relative humidity conditions existing during time of fabrication and in installation areas.

B. **Fabricate finish carpentry to dimensions**, profiles, and details indicated.
   1. Back out or kerf backs of the following members, except members with ends exposed in finished work:
      a. Interior standing and running trim.
   2. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius.
   3. Ease edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Clean substrates** of projections and substances detrimental to application.

B. **Condition finish carpentry** to average prevailing humidity conditions in installation areas before installation, for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

C. **Prime and backprime** lumber for painted finish. Comply with requirements for surface preparation and application in Division 9 Section "Painting."

3.3 INSTALLATION, GENERAL

A. **Do not use finish carpentry materials that are unsound,** warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. **Install finish carpentry plumb**, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
   1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.
   3. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   4. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.

C. **Window Sills**: Anchor securely by screwing through corner blocks or other supports into underside of window sills.
   1. Align adjacent solid-surfacing-material window sills and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Where windows are interior, provide solid-surfacing on both sides of the window unless a ceramic tile or wood window sill is indicated on the drawings.

3.4 WOOD STANDING AND RUNNING TRIM INSTALLATION - INCLUDING WALL CAPS

A. **Install with minimum number of joints practical,** using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required.
   1. Match color and grain pattern across joints.
   2. Install trim after gypsum board joint finishing operations are completed.
   3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

A. **Repair damaged or defective finish carpentry** where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

3.6 CLEANING

A. **Clean finish carpentry** on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. **Provide final protection** and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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SECTION 07 1113

BITUMINOUS DAMP PROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** dampproofing, applied where indicated in Part 3 or as noted on Drawings.

B. **Related Sections**:
1. Section 07 1320 "**Self-Adhering Sheet Waterproofing**" for areas enclosing occupied spaces, including below grade mechanical rooms.

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

B. **Material Certificates**: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

A. **Source Limitations**: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. **Weather Limitations**: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

B. **Ventilation**: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. **Cold-Applied, Emulsified-Asphalt Dampproofing**:
   a. Carlisle Coatings & Waterproofing; Barricoat-R, Roller Applied Waterproofing Membrane
   b. Karnak Corporation; Fibered Dampproofing (brush or spray applied).
   c. Master Builders Solutions: Masterseal 615

2.2 BITUMINOUS DAMPPROOFING

A. **Odor Elimination**: For interior and concealed-in-wall uses other than exterior face of inner wythe of cavity walls, provide dampproofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.

B. **Cold-Applied, Emulsified-Asphalt Dampproofing**:
   1. Trowel Coats: ASTM D 1227, Type II, Class 1.
   2. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
   3. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 MISCELLANEOUS MATERIALS

A. **Emulsified-Asphalt Primer**: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. **Asphalt-Coated Glass Fabric**: ASTM D 1668, Type I.

C. **Protection Course, Asphalt-Board Type**: Pre-molded, 1/8-inch- thick, multi-ply, semi-rigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
   1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

B. **Architect will examine the installation** of dampproofing prior to backfilling. If backfilling occurs prior to Architect's examination, Contractor shall remove backfill, at Contractor's expense, to allow for Architect's examination.

3.2 PREPARATION

A. **Protection of Other Work**: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. **Cleaning**: Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. **Comply with manufacturer's written recommendations** unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
   1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
   2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

B. **Apply dampproofing to footings and foundation walls** whether indicated or not.
   1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
   2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
   3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. **On Concrete Foundations (not enclosing occupiable space)**: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, one fibered brush or spray coat at not less than 3 gal./100 sq. ft., or one trowel coat at not less than 4 gal./100 sq. ft..

B. **On Backs of Concrete Retaining Walls**: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..

C. **On Backs of Masonry Retaining Walls**: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft..

D. **On Exterior Face of Inner Wythe of Cavity Walls**: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

3.5 INSTALLATION OF PROTECTION COURSE

A. **Install protection course** over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.6 CLEANING

A. **Remove dampproofing materials** from surfaces not intended to receive dampproofing.

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SECTION 07 2100

BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
   1. Concealed building insulation (batts and rigid).
   2. Fire safing insulation.

1.3 SUBMITTALS

A. **Product Data**: Provide product data for each type of insulation product specified.

B. **Product Test Reports**: Provide product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. **Single-Source Responsibility for Insulation Products**: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. **Fire-Test-Response Characteristics**: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

C. **Mock-Ups**: Before installing building insulation, build a mockup in an area or room as directed by the Architect, for each insulation condition to be a standard for insulation installation.
   1. Mock-up to include batt insulation, conditions where insulation is covered with gypsum board and where insulation is to be left exposed such as above ceilings.
   2. Approved mock-up may remain a part of the permanent construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Protection**: Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. **Protect plastic** insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:
1. Glass-Fiber Insulation:
   a. CertainTeed Corporation.
   b. Knauf Fiber Glass GmbH.
   c. Owens-Corning Fiberglas Corporation.
   d. Johns Manville Corporation.
2. Polystyrene Board Insulation:
   a. DiversiFoam Products.
   b. DuPont.
   c. Owens-Corning Co.

2.2 INSULATING MATERIALS

A. **General:** Provide insulating materials that comply with requirements and with referenced standards.

B. **Unfaced Mineral-Fiber Blanket Insulation**: (blankets without membrane facing). Thermal/sound attenuation insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, **Type I**
1. Mineral-Fiber Type: Fibers manufactured from glass.
2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.
3. Install in sufficient depth to fully fill wall cavity.

C. **Extruded Polystyrene Board** Insulation**:** (Perimeter insulation below grade) Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C 578 for type and with other requirements indicated below:
1. Type IV, 1.60-lb/cu. ft. minimum density, unless otherwise indicated.
2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively.
3. Thickness: 2 inches minimum.

2.3 FIRE SAFING INSULATION AND ACCESSORIES

A. **Slag-Wool-Fiber Board Safing Insulation**:
   1. Semi-rigid boards designed for use as fire stop at openings between edge of slab and exterior wall panels and other locations as required for fire stopping.
   2. Boards are to be produced by combining slag-wool fibers with thermosetting resin binders.
   3. Comply with ASTM C 612, Type IA and IB.
   4. Density: Nominal density of 4 lb/cu. ft.
   5. Safing to pass: ASTM E 136 for combustion characteristics; thermal resistivity of 4 degrees F x h x sq. ft./Btu x in. at 75 degrees F.

B. **Caulking Compound**: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.

C. **Safing Clips**: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.4 AUXILIARY INSULATING MATERIALS

A. **Adhesive for Bonding Insulation**: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.5 INSULATION FASTENERS

A. **Adhesively Attached, Spindle-Type Anchors**: Plate welded to projecting spindle; capable of holding insulation, of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
   1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches in diameter, length to suit depth of insulation indicated.

B. **Insulation-Retaining Washers**: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

C. **Anchor Adhesive**: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates** and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected. The Architect shall examine the installation of the insulation prior to insulation being covered by other work. If insulation is covered prior to Architects examination, Contractor shall remove other work, at contractor's expense to allow for Architect's examination.

3.2 PREPARATION

A. **Clean substrates** of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. **Comply with insulation manufacturer's written instructions** applicable to products and application indicated.

B. **Install insulation** that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. **Extend insulation** in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. **Apply single layer of insulation** to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION (ABOVE GRADE)

A. **Apply insulation** units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. **Seal joints** between closed-cell (non-breathing) foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. **Install mineral-fiber blankets** in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Insulation is to extend from floor to deck, typical.

D. **Stuff glass-fiber loose-fill insulation** into miscellaneous voids and cavity spaces. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.5 INSTALLATION OF SAFING INSULATION

A. **Install safing** insulation to fill gap between edge of concrete floor slab and back of exterior spandrel panels on safing clips spaced as needed to support insulation, but not further apart than 24 inches o.c. Cut safing insulation wider than gap to be filled to ensure compression fit and seal joint between insulation and edge of slab with calking approved by safing insulation manufacturer for this purpose. Leave no voids in completed installation.

3.6 PROTECTION

A. **General:** Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

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SECTION 07 2613

SELF-ADHERING AIR AND VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Section includes** water-resistant self-adhering sheet air and vapor barrier in exterior wall assemblies.

B. **Related Work** in other Sections includes the following:
   1. Section 06 1610 "**Wood Sheathing"** for requirement that sheathing has been installed with damaged corners repaired, joints filled and surface flush with compatible material as acceptable to the self-adhering air and vapor barrier manufacturer; requirement for gap at deflection joints and fillers.

1.2 PERFORMANCE REQUIREMENTS

A. **Material Performance:** Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 pounds per square foot) when tested according to ASTM E 2178, and a vapor permeance of 0.1 perms or less when tested according to ASTM E 96.

B. **Assembly Performance:** Provide a continuous air and vapor barrier assembly that has an air leakage not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 pounds per square foot) when tested in accordance with ASTM E 2357. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.
   1. Assembly shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.
   2. Assembly shall not displace adjacent materials under full load.
   3. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.

C. **Connections to Adjacent Materials:** Provide connections to prevent air leakage and vapor migration at the following locations:
   1. Walls, windows, curtain walls, storefronts, louvers or doors.
   2. Different wall assemblies, and fixed openings within those assemblies.
   3. Wall and roof connections.
   4. Walls, floor and roof across construction, control and expansion joints.
   5. Seismic and expansion joints.
   6. All other leakage pathways in the building envelope.

1.3 SUBMITTALS

A. **Submittals:** Submit in accordance with Division 1 requirements.

B. **Quality Assurance Program:** Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of contractor and certification number of installers.

C. **Product Data:** Submit manufacturer's product data, manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
   1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
   2. Include statement that materials are compatible with adjacent materials proposed for use.
   3. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

D. **Samples:** Submit clearly labeled samples, 3 by 4 inch minimum size of each material specified.

E. **Shop Drawings:** Submit shop drawings showing locations and extent of air and vapor barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air and vapor barrier are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.
   1. Include statement that materials are compatible with adjacent materials proposed for use.

F. **Compatibility:** Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

1.4 QUALITY ASSURANCE

A. **Air Barrier Contractor Qualifications:** Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.

B. **Manufacturer:** Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. **Accredited Laboratory Testing for Materials:** Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

D. **Preconstruction Meeting:** Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Deliver materials to Project site in original packages** with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. **Store materials in their original undamaged packages** in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.

C. **Handle materials** in accordance with manufacturer's recommendations.

1.6 PROJECT CONDITIONS

A. **Temperature:** Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer. Do not apply air and vapor barrier to a damp or wet substrate.

B. **Field Conditions:** Do not install air and vapor barrier in snow, rain, fog, or mist. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.7 WARRANTY

A. **Material Warranty:** Provide manufacturer's standard product warranty, for a minimum **3 years** from date of Substantial Completion.

B. **Installation Warranty:** Provide installer's 2-year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of airtight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Sheet Air and Vapor Barrier:** Self-adhering membrane composed of flexible facing material coated completely and uniformly on one side with adhesive material, formed into uniform, flexible sheets, interleaved with disposable release liner that is removed prior to application. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer. Subject to compliance with requirements, provide one of the following:

1. Carlisle Coatings and Waterproofing:
   a. Air and Vapor Barrier Membrane: CCW-705, 40 mils thick.
   b. Water-Based Primer: CCW-AWP Water-Based Primer.
   c. Solvent-Based Primer: CCW-702 Solvent-Based Primer.
   d. Solvent-Based Aerosol Primer: CAV-GRIP.
   e. Counterflashing for Masonry Through-Wall Flashings: CCW-705 TWF.
   f. Mastics, Adhesives and Tapes: CCW-704 Solvent-Based Rubberized Asphalt Mastic.
2. Grace Construction Products:
   a. Air and Vapor Barrier Membrane: Perm-A-Barrier, 40 mils thick.
   b. Water-Based Primer: Perm-A-Barrier WB Primer.
   c. Solvent-Based Primer: Bituthene Primer B-2.
   d. Counterflashing for Masonry Through-Wall Flashings: Perm-A-Barrier Flashing.
   e. Mastics, Adhesives and Tapes: As recommended by manufacturer.
3. Henry:
   a. Air and Vapor Barrier Membrane: Blueskin SA, 40 mils thick.
   b. Water-Based Primer: Aquatac.
   c. Solvent-Based Primer: Blueskin Primer.
   d. Counterflashing for Masonry Through-Wall Flashings: Blueskin TWF.
   e. Mastics, Adhesives and Tapes: Henry 570-05 Polybitume.
4. Tremco, Inc.
   a. Air and Vapor Barrier Membrane: ExoAir 110, 40 mils thick.
   b. Water-Based Primer: ExoAir WB Primer.
   c. Solvent-Based Primer: ExoAir Primer or GM Primer or ExoAir 10 Primer as recommended.
   d. Counterflashing for Masonry Through-Wall Flashings: ExoAir TWF.
   e. Mastics, Adhesives and Tapes: As recommended by manufacturer.
5. W. R. Meadows, Inc.:
   a. Air and Vapor Barrier Membrane: Air-Shield, 40 mils thick.
   b. Water-Based Primer: Mel-Prime Water Base.
   c. Solvent-Based Primer: Mel-Prime VOC.
   d. Counterflashing for Masonry Through-Wall Flashings: Detail Strip.
   e. Mastics, Adhesives and Tapes: As recommended by manufacturer.

2.2 AUXILIARY MATERIALS

A. **Sealant at Transitions in Substrate and Connections to Adjacent Elements:** Low-modulus pre-cured silicone extrusion and sealant for bonding extrusions to substrates; Tremco Silicone Extruded Sheet by Tremco, Spectrem EZ Seal by Tremco, Bondaflex Silbridge 300 by May National Associates, or custom fabricated system by ABAA approved installer.

B. **Transition Membrane between Air and Vapor Barrier Membrane and Roofing and Other Adjacent Materials:** Comply with both air and vapor barrier manufacturer's recommendations and material manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.
   1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
   2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.
   3. Ensure that the following conditions are met:
      a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
      b. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test.
      c. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
      d. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

A. **Clean, prepare, and treat substrate** according to manufacturer's written instructions. Ensure clean, dust-free, and dry substrate for air and vapor barrier application.
   1. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
   2. Prime wood, metal, and painted substrates with primer.
   3. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.

3.3 INSTALLATION

A. **Self-Adhering Sheet Air and Vapor Barrier:** Install membrane to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and the following:
   1. Apply primer at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application. Apply as many coats as necessary for proper adhesion.
   2. When membrane is properly positioned, press into place and roll membrane with roller immediately after placement.
   3. Apply membrane sheets to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.
   4. Position subsequent sheets of membrane applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.

5. Overlap horizontally adjacent pieces a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.
6. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.
7. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.
8. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
9. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate.
10. At through-wall flashings, provide an additional 6-inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic as recommended by manufacturer.
11. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
12. At expansion and seismic joints provide transition to the joint assemblies.
13. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
14. At end of each working day, seal top edge of membrane to substrate with termination mastic.
15. Do not allow materials to come in contact with chemically incompatible materials.
16. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
17. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.4 PROTECTING AND CLEANING

A. **Protect** air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer.

B. **Clean** spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION

SECTION 07 4213

METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
1. Exposed fastener, lap seam metal wall panel.
2. Provide components required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items

B. **Related Sections** include the following:
1. Section 05 4200 "**Cold-Formed Metal Framing**" for installation of metal strips coordinated with spacing of metal panel fasteners.
2. Section 07 6200 "**Sheet Metal Flashing and Trim**" for flashings and other sheet metal work not part of metal wall panel assemblies.
3. Section 07 9200 "**Joint Sealants**" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITION

A. **Metal Wall Panel Assembly**: Metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight system.

1.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. **Air Infiltration**: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.

C. **Water Penetration**: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft.

D. **Structural Performance**: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Drawings.
   2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/240 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
      a. Test Pressures: 150 percent of inward and outward wind-load design pressures.

E. **Seismic Performance**: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

F. **Thermal Movements**: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

1.5 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. **Shop Drawings**: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
      a. Flashing and trim.

C. **Coordination Drawings**: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
   1. Wall panels and attachments.
   2. Stud framing.
   3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.

E. **Samples for Selection**: For each type of metal wall panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

F. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
   1. Metal Wall Panels: Include reports for air infiltration, water penetration, and structural performance.

G. **Maintenance Data**: For metal wall panels to include in maintenance manuals.

H. **Warranties**: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. **Installer Qualifications**: An employer of workers trained and approved by manufacturer.

B. **Fabricator Qualifications**: Certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer's wall panel system.

C. **Source Limitations**: Obtain each type of metal wall panel through one source from a single manufacturer.

D. **Product Options**: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. **Mockups**: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
   1. Build mockup of typical corner wall panel; approximately 48 inches (1200 mm) square by full thickness, including insulation, supports, attachments, and accessories.
   2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

A. **Deliver components, sheets, metal wall panels**, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. **Unload, store, and erect metal wall panels** in a manner to prevent bending, warping, twisting, and surface damage.

C. **Stack metal wall panels horizontally** on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. **Protect strippable protective covering** on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.8 PROJECT CONDITIONS

A. **Weather Limitations**: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. **Field Measurements**: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

A. **Coordinate metal wall panel assemblies** with rain drainage work, flashing, trim, and construction of studs, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. **Special Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. **Special Warranty on Panel Finishes**: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. **Special Weathertightness Warranty**: Manufacturer's standard form in which manufacturer agrees to repair or replace metal wall panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Weathertight Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. **General:** Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

B. **Basis of Design**: Contract Documents are based on products below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
   1. Manufacturer: MBCI; mbci.com
   2. Products: PBR.

C. **Product Characteristics**:
   1. Coverage Width: 36 inches.
   2. Rib Spacing: 12 inches on center.
   3. Rib Height: 1-1/4 inch.
   4. Thickness: 26 ga.

2.2 PANEL MATERIALS

A. **Metallic-Coated Steel Sheet Pre-painted with Coil Coating**: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
   2. Surface: Smooth, flat finish.
   3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with physical properties and coating performance requirements of AAMA 621, except as modified below:
            (a) Humidity Resistance: 2000 hours.
            (b) Water Resistance: 2000 hours.
   4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

C. **Panel Sealants**:
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 MISCELLANEOUS METAL FRAMING

A. **Steel Sheet Components, General**: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

B. **Fasteners for Metal Framing**: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 MISCELLANEOUS MATERIALS

A. **Fasteners**: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
   1. Fasteners for Wall Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.

2. Exposed Fasteners for Composite Panels: Stainless steel.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. **Bituminous Coating**: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 METAL TRIMS

A. **General:** Provide custom metal trims and panels for closures to windows and other penetrations of metal wall panel systems.

B. **Flat Plate, Exposed-Fastener Metal Trims**
1. Material: Weathering steel, ASTM A588, 1/2 inch thick.

2.6 ACCESSORIES

A. **Wall Panel Accessories**: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. **Flashing and Trim**: Formed from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

C. **Fasteners**: Stainless steel, finished to match steel.

2.7 FABRICATION

A. **General**: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.

B. **Fabricate metal wall panels** in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. **Sheet Metal Accessories**: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.8 FINISHES, GENERAL

A. **Comply with NAAMM's** "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. **Protect mechanical and painted finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine wall framing to verify that studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
   3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. **Examine roughing-in** for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Install flashings** and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

B. **Install fasciae and copings** to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. **Miscellaneous Framing**: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

A. **General**: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
   a. Screws shall align vertically and horizontally in all panels with exposed fasteners.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. **Fasteners**: Stainless-steel fasteners for surfaces exposed to the exterior.

C. **Metal Protection**: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

D. **Joint Sealers**: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.

3.4 FIELD-ASSEMBLED METAL WALL PANEL INSTALLATION

A. **Lap-Seam Metal Wall Panels**: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps, and on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.
7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

3.5 ACCESSORY INSTALLATION

A. **General**: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. **Flashing and Trim**: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

A. **Installation Tolerances**: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. **Remove temporary protective coverings** and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. **After metal wall panel installation**, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. **Replace metal wall panels** that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following sheet metal flashing and trim:
   1. Manufactured reglets.
   2. Formed wall flashing and trim.
   3. Formed equipment support flashing.

B. **Related Sections** include the following:
   1. Section 06 1000 "**Rough Carpentry**" for wood nailers and blocking.
   2. Section 07 9200 "**Joint Sealants**" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. **General**: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. **Wind Loading**: Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.

C. **Thermal Movements**: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

D. **Water Infiltration**: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. **Shop Drawings**: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
   4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. **Samples for Selection**: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. **Sheet Metal Flashing and Trim Standard**: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Deliver** sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. **Unload, store, and install** sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. **Stack materials** on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. **Coordinate installation** of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **In other Part 2 articles where titles below introduce lists**, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METALS

A. **Zinc-Coated (Galvanized) Steel Sheet**: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting.

B. **Pre-painted, Metallic-Coated Steel Sheet**: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   2. Exposed Finishes: Apply the following coil coating:
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with physical properties and coating performance requirements of AAMA 621, except as modified below
            (a) Humidity Resistance: 2000 hours.
            (b) Salt-Spray Resistance: 2000 hours.
         2) Color: As selected by Architect to match wall from manufacturer's full range including deep tone colors and metallics.
   3. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.
   4. Zinc Sheet: Electrolytic, 99 percent pure zinc alloyed with 1 percent titanium and copper.
      a. Finish: Bright rolled.

2.3 UNDERLAYMENT MATERIALS

A. **Polyethylene Sheet**: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. **Slip Sheet**: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.4 MISCELLANEOUS MATERIALS

A. **General**: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. **Fasteners**: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
   4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. **Solder for Zinc**: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. **Sealing Tape**: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. **Elastomeric Sealant**: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. **Butyl Sealant**: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. **Bituminous Coating**: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. **Reglets**: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.
   1. Available Manufacturers:
      a. Fry Reglet Corporation.
   2. Material: Galvanized steel, 24 gauge.
   3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   4. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 FABRICATION, GENERAL

A. **General**: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. **Fabricate** sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. **Fabricate** sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. **Sealed Joints**: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. **Seams**: Comply with SMACNA “Architectural Sheet Metal Manual”, (Sixth Edition, September 2003) Figure no. 3-2 and 3-3 as applicable to specific installations.
1. Standing Seams: Provide double lock standing seams (detail no. 25, figure no. 3-3) with finish not less than 1-1/4 inches high.

F. **Expansion Provisions**: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. **Conceal fasteners** and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

H. **Fabricate cleats** and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. **Thickness**: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.7 WALL SHEET METAL FABRICATIONS

A. **Through-Wall Flashing**: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high end dams. Fabricate from the following material:
1. Zinc: 15 gauge (0.040 inch) thick.

B. **Openings Flashing in Frame Construction**: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:
1. Prepainted, Metallic-Coated Steel: 24 gauge.

C. **Wall Expansion-Joint Cover**: Fabricate from the following material:
1. Prepainted, Metallic-Coated Steel: 24 gauge.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. **Equipment Support Flashing**: Fabricate from the following material:
1. Galvanized Steel: 24 gauge.

2.9 FINISHES

A. **Comply** with NAAMM's "**Metal Finishes Manual for Architectural and Metal Products**" for recommendations for applying and designating finishes.

B. **Protect mechanical and painted finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. **General**: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. **Metal Protection**: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. **Install exposed sheet metal flashing** and trim without excessive oil canning, buckling, and tool marks.

D. **Install sheet metal flashing** and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. **Install flashing** and trim so that **any edge that can be seen** will not reveal the **back side** of the flashing.

F. **Install sheet metal flashing and trim** to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

G. **Expansion Provisions**: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. **Fasteners**: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch (19 mm) for wood screws.
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

I. **Seal joints** with elastomeric sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 degrees F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

J. **Soldered Joints**: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
1. Do not solder prepainted, metallic-coated steel sheet.
2. Pretinning is not required for lead.
3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 WALL FLASHING INSTALLATION

A. **General**: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. **Through-Wall Flashing**: Installation of formed through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

C. **Reglets**: Installation of reglets is specified in Division 3 Section "Cast-in-Place Concrete.

D. **Openings Flashing in Frame Construction**: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. **Equipment Support Flashing**: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.5 CLEANING AND PROTECTION

A. **Clean exposed metal surfaces** of substances that interfere with uniform oxidation and weathering.

B. **Clean and neutralize flux materials**. Clean off excess solder and sealants.

C. **Remove temporary protective coverings** and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. **Replace sheet metal flashing** and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and non-traffic horizontal surfaces:
    a. Control and expansion joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints in metal panel systems.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors and windows.
    f. Control and expansion joints in ceiling and overhead surfaces.
    g. Other joints as indicated.
2. Exterior joints in the following horizontal traffic surfaces:
    a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
    b. Tile control and expansion joints.
    c. Joints between different materials listed above.
    d. Other joints as indicated.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    a. Control and expansion joints on exposed interior surfaces of exterior walls
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    g. Joints between interior partitions and concrete floors.
    h. Other joints as indicated.
4. Interior joints in the following horizontal traffic surfaces:
    a. Control and expansion joints in cast-in-place concrete slabs.
    b. Control and expansion joints in tile flooring.
    c. Other joints as indicated.
5. All joints between dissimilar materials.

1.3 PERFORMANCE REQUIREMENTS

A. **Provide elastomeric joint sealants** that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. **Product Data**: For each joint-sealant product indicated.

B. **Samples for Selection**: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. **Product Certificates**: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

1.5 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. **Source Limitations**: Obtain each type of joint sealant through one source from a single manufacturer.

C. **Preconstruction Compatibility and Adhesion Testing**: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    a. Perform tests under environmental conditions replicating those that will exist during installation.
2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. **Mockups**: Before installing joint sealants, apply elastomeric sealants as follows to verify color selections and to demonstrate aesthetic effects and qualities of materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.
2. Provide not less than six and not more than twelve 12-inch long x typical width and depth samples of sealants and caulks for Owner and Architect review. Samples shall be installed at floors, walls, ceiling and other locations selected by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Deliver materials** to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. **Store and handle materials** in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. When joint substrates are wet.

B. **Joint-Width Conditions**: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. **Joint-Substrate Conditions**: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. **Special Installer's Warranty**: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion.

B. **Special warranties** specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. **Compatibility**: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. **Colors of Exposed Joint Sealants**: As selected by Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS

A. **Elastomeric Sealant Standard**: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. **Additional Movement Capability**: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. **Suitability for Contact with Food**: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.3 SOLVENT-RELEASE JOINT SEALANTS

A. **Acrylic-Based Solvent-Release Joint-Sealant Standard**: Comply with ASTM C 1311 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

B. **Butyl-Rubber-Based Solvent-Release Joint-Sealant Standard**: Comply with ASTM C 1085 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

2.4 LATEX JOINT SEALANTS

A. **Latex Sealant Standard**: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.5 ACOUSTICAL JOINT SEALANTS

A. **Acoustical Sealant for Exposed and Concealed Joints**: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.6 JOINT-SEALANT BACKING

A. **General**: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. **Cylindrical Sealant Backings**: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. **Type C**: Closed-cell material with a surface skin.

D. **Elastomeric Tubing Sealant Backings**: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

E. **Bond-Breaker Tape**: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. **Primer**: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. **Cleaners for Nonporous Surfaces**: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. **Masking Tape**: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. All joints of **dissimilar materials** to receive joint sealant.

B. **Examine joints** to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Surface Cleaning of Joints**: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include concrete, masonry or unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants to metal, glass, porcelain enamel or glazed surfaces of ceramic tile.

B. **Joint Priming**: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. **Masking Tape**: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. **General**: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. **Sealant Installation Standard**: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. **Acoustical Sealant Application Standard**: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. **Install sealant backings** of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. **Install bond-breaker tape** behind sealants where sealant backings are not used between sealants and back of joints.

F. **Install sealants** by proven techniques to comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Seal abutting joint at all dissimilar materials.

G. **Tooling of Nonsag Sealants**: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
    a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. **Clean off excess sealants** or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. **Protect joint sealants** during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. A. **Medium-Modulus Neutral-Curing Silicone Sealant**:
1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
    a. 791; Dow Corning.
    b. PSI-631; Polymeric Systems, Inc.
    c. MasterSeal NP 150, Master Builders Solutions.
    d. Spectrem 2; Tremco.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M (masonry), G (glass), A (aluminum), and, as applicable to joint substrates indicated, O (other).
    a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
7. Applications: Exterior and interior joints in vertical surfaces of concrete; between metal and concrete and mortar; perimeter of metal frames in exterior walls; overhead or ceiling joints.

B. **Mildew-Resistant Silicone Sealant**:
1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
    a. 786 Mildew Resistant; Dow Corning.
    b. Sanitary 1700; GE Silicones.
    c. Tremsil 600 White; Tremco.
    d. MasterSeal NP 150, Master Builders Solutions.
2. Type and Grade: S (single component) and NS (nonsag); formulated with fungicide.

3. Class: 25.
4. Use Related to Exposure: NT (nontraffic); intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.
6. Applications: Interior joints in vertical surfaces of ceramic tile in toilet rooms, and showers.

C. **Multicomponent Pourable Urethane Sealant**:
1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
    a. Vulkem 245; Mameco International.
    b. Elasto-Thane 920 Pourable; Pacific Polymers, Inc.
    c. Sikaflex - 2c SL; Sika Corporation.
    d. MasterSeal SL 2; Master Builders Solutions.
2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
6. Applications: Traffic joints.

D. **Single-Component Nonsag Urethane Sealant**:
1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
    a. Vulkem 921; Mameco International.
    b. Dynatrol I; Pecora Corporation.
    c. DyMonic; Tremco.
    d. MasterSeal NP1, Master Builders Solutions.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
6. Applications: Joints in concrete.

3.7 LATEX JOINT-SEALANT SCHEDULE

A. **Latex Sealant**:
1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
    a. AC-20; Pecora Corporation.
    b. Tremflex 834; Tremco.

2. Applications: Interior joints in field-painted vertical and overhead surfaces at hollow metal door frames, gypsum drywall, and concrete; and all other interior locations not indicated otherwise.

3.8 ACOUSTICAL JOINT-SEALANT SCHEDULE

A. **Acoustical Sealant for Exposed and Concealed Joints**:

1. Available Products: Subject to compliance with requirements of Contract Documents, products which may be incorporated into the Work include, but are not limited to, the following:
   a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
   b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
   c. SpecSeal® Smoke 'N' Sound Acoustical Sealant; STI.
2. Applications: Use in locations of sound walls and in locations indicated.

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DIVISION 08 - OPENINGS

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SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes**:
1. Steel doors.
2. Hollow metal door frames.
3. Hollow metal window frames
4. Fire rated doors and frame assemblies.

B. **Related Sections**
1. Section 08 1416 **"Flush Wood Doors**" for wood doors installed in steel frames.
2. Section 08 7100 "**Door Hardware**" for door hardware for hollow metal doors.
3. Section 08 8000 "**Glazing**" for glass in glazed openings.
4. Section 09 2900 "**Gypsum Board**" for spot grouting frames installed in steel framed gypsum board partitions
5. Sections 09 9123 "**Painting**" for field painting hollow metal doors and frames.
6. **Division 26** Sections for **electrical connections** including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. **Minimum Thickness**: Minimum thickness of base metal without coatings.

B. **Standard Hollow Metal Work**: Hollow metalwork fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. **Shop Drawings**: Include the following:
1. Elevations of each door and window frame design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. **Other Action Submittals**:
   1. **Schedule:** Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. **Oversize Construction Certification**: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

E. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. **Source Limitations**: Obtain hollow metal work from single source from single manufacturer.

B. **Fire-Rated Door Assemblies**: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated, but not limited to, vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire-test exposure.

C. **Fire-Rated, Borrowed-Light Frame Assemblies**: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Deliver** hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. **Deliver welded frame**s with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. **Store hollow metal work under cover at Project site**. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. **Field Measurements**: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Manufacturers**: Subject to compliance with requirements of Contract Documents, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amweld Building Products, LLC.
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Pioneer Industries, Inc.
   5. Steelcraft; an Allegion company.
   6. Windsor Republic Doors.
   7. Security Metal Products Corp.

2.2 MATERIALS

A. **Cold-Rolled Steel Sheet:** ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. **Metallic-Coated Steel Sheet**: ASTM A 653, Commercial Steel (CS), Type B; with minimum A60 metallic coating.

E. **Frame Anchors:** ASTM A 591, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

F. **Inserts, Bolts, and Fasteners:** Hot-dip galvanized according to ASTM A 153.

G. **Powder-Actuated Fasteners in Concrete**: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

H. **Grout:** ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.

I. **Mineral-Fiber Insulation:** ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. **Glazing:** Comply with requirements in Division 8 Section "Glazing."

K. **Bituminous Coating**: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. **General:** Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
      a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 2.3 degrees F x h x sq. ft./Btu when tested according to ASTM C 1363.
         1) Locations: Exterior doors and interior doors where indicated.
   3. Vertical Edges for Single-Acting Doors: Beveled edge.
      a. Beveled Edge: 1/8 inch in 2 inches.
   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
   5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. **Exterior Doors:** Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless) (14 gauge face).

C. **Interior Doors:** Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level A (Heavy Duty), Model 2 (Seamless) (18 gauge face).

D. **Hardware Reinforcement:** Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. **Fabricate concealed stiffeners** and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. **General:** Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. **Exterior Frames**: Fabricated from metallic-coated steel sheet.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as fully welded unless otherwise indicated.
   3. Frames for Level 4 Steel Doors: 14 gauge (0.067-inch) thick steel sheet.

C. **Interior Frames:** Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as fully welded unless otherwise indicated.
   3. Frames for Level 2 Steel Doors: 16 gauge (0.053-inch) thick steel sheet.
   4. Frames for Wood Doors: 16 gauge (0.053-inch) thick steel sheet.
   5. Frames for Borrowed Lights: 16 gauge (0.053-inch) thick steel sheet.

D. **Hardware Reinforcement**: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. **Jamb Anchors**:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 19 gauge (0.042 inch) thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 26 gauge (0.177 inch) thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 19 gauge (0.042 inch) thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. **Floor Anchors:** Formed from same material as frames, not less than 19 gauge (0.042 inch) thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. **Moldings for Glazed Lites in Doors**: Minimum 21 gauge (0.032 inch) thick, fabricated from same material as door face sheet in which they are installed.

B. **Fixed Frame Moldings**: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. **Loose Stops for Glazed Lites in Frames:** Minimum 21 gauge **(**0.032 inch) thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. **Mullions and Transom Bars**: Join to adjacent members by welding or rigid mechanical anchors.

B. **Ceiling Struts**: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. **Grout Guards:** Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

A. **Fabricate hollow metal work** to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. **Tolerances:** Fabricate hollow metal work to tolerances indicated in SDI 117.

C. **Hollow Metal Doors**:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. **Hollow Metal Frames**: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
   1) Three anchors per jamb up to 60 inches high.
   2) Four anchors per jamb from 60 to 90 inches high.
   3) Five anchors per jamb from 90 to 96 inches high.
   4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
   5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. **Fabricate concealed stiffeners**, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. **Hardware Preparation:** Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
5. Provide auxiliary hinge reinforcement at all hinge locations on every frame.

G. **Stops and Moldings**: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. **Prime Finish:** Apply manufacturer's standard primer immediately after cleaning and pretreating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. **Examine roughing-in** for embedded and built-in anchors to verify actual locations before frame installation.

C. **For the record, prepare written report,** endorsed by Installer, listing conditions detrimental to performance of the Work.

D. **Proceed with installation** only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Remove welded-in shipping spreaders** installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. **Prior to installation**, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. **Drill and tap doors and frames** to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. **General:** Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. **Hollow Metal Frames**: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. **Installation Tolerances:** Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. **Hollow Metal Doors**: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. **Glazing:** Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. **Final Adjustments:** Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. **Remove grout** and other bonding material from hollow metal work immediately after installation.

C. **Prime-Coat Touchup**: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. **Metallic-Coated Surfaces:** Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 3100

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following:
   1. Wall access doors and frames.
   2. Ceiling access doors and frames.

B. **Related Sections** include the following:
   1. Section 23 3300 "**Duct Accessories**" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. **Product Data**: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. **Shop Drawings**: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. **Schedule**: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

D. **Coordination Drawings**: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:
   1. Method of attaching door frames to surrounding construction.
   2. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

1.4 QUALITY ASSURANCE

A. **Source Limitations**: Obtain doors and frames through one source from a single manufacturer.

B. **Size Variations**: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. **Verification**: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Acudor Products, Inc., part of Nelson Industrial Inc.
2. Babcock-Davis, Inc.
3. Bilco Co.
4. Dur-Red Products.
5. J. L. Industries, Inc., a part of the Activar Construction Products Group.
6. Karp Associates, Inc.
7. Larsen's Manufacturing Company, a member of Morris Group International.
8. Milcor/Hart & Cooley, Inc., a registered trademark of Johnson Controls, Inc.
9. Nystrom.

2.2 MATERIALS

A. **Steel Plates, Shapes, and Bars**: ASTM A 36/A 36M.

B. **Electrolytic Zinc-Coated Steel Sheet**: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.

C. **Drywall Beads**: Edge trim formed from 22 gauge zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 PAINT

A. **Shop Primer for Ferrous Metal**: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.4 ACCESS DOORS AND FRAMES

A. **Flush, Insulated, Fire-Rated Access Doors and Trimless Frames**: Fabricated from steel sheet.
   1. Locations: Gypsum board wall and ceiling surfaces. Fire resistance rating to be 1 hour minimum rating or as scheduled on the drawings.
   2. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 20 gauge.
   3. Frame: Minimum 16 gauge sheet metal with drywall bead.
   4. Hinges: Continuous piano hinge.
   5. Automatic Closer: Spring type.
   6. Latch: Self-latching bolt operated by knurled knob with interior release.
   7. Lock: Key-operated cylinder lock with interior release.
   8. Size: As indicated on Drawings or, if not indicated, as required for proper access.

B. **Flush Access Doors and Frames with Exposed Trim**: Fabricated from steel sheet.
   1. Locations: Masonry, concrete and ceramic-tile wall surfaces.
   2. Door: Minimum 16 gauge sheet metal, set flush with exposed face flange of frame.
   3. Frame: Minimum 16 gauge sheet metal with 1-inch wide, surface-mounted trim.
   4. Hinges: Continuous piano hinge.
   5. Latch: Screwdriver-operated cam latch.
   6. Lock: Key-operated cylinder lock.
   7. Size: As indicated on Drawings or, if not indicated, as required for proper access.

C. **Flush Access Doors and Trimless Frames**: Fabricated from steel sheet.
   1. Locations: Gypsum board wall and ceiling surfaces.
   2. Door: Minimum 16 gauge sheet metal, set flush with surrounding finish surfaces.
   3. Frame: Minimum 16 gauge sheet metal with drywall bead.
   4. Hinges: Continuous piano hinge.
   5. Latch: Screwdriver-operated cam latch.
   6. Lock: Key-operated cylinder lock.
   7. Size: As indicated on Drawings or, if not indicated, as required for proper access.

2.5 FABRICATION

A. **General**: Provide access door 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. **Steel Doors and Frames**: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
   2. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.
   3. Provide mounting holes in frames to attach frames to framing in drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.

D. **Latching Mechanisms**: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.7 METALLIC-COATED STEEL FINISHES

A. **Galvanizing of Steel Shapes and Plates**: Hot-dip galvanize items indicated to comply with applicable standard listed below:
   1. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. **Surface Preparation**: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. **Factory Priming for Field-Painted Finish**: Apply shop primer immediately after cleaning and pretreating.

2.8 STEEL FINISHES

A. **Surface Preparation**: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. **Apply shop primer** to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. **Advise installers** of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. **Comply with manufacturer's written instructions** for installing access doors and frames and floor doors and frames.

B. **Set frames accurately in position** and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. **Install access doors with trimless frames** and floor doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. **Adjust doors and hardware** after installation for proper operation.

B. **Remove and replace doors and frames** that are warped, bowed, or otherwise damaged.

END OF SECTION

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SECTION 08 3613

SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following types of sectional overhead doors:
   1. Insulated steel doors with aluminum sash sections
   2. Tracks configured as indicated on Drawings or as required for application.

B. **Related Sections** include the following:
   1. Section 08 7100 "**Door Hardware**" for lock cylinders and keying.
   2. Section 26 0120 "**Conductors and Cables**" for electrical service and connections for powered operators, and accessories.
   3. Section 26 0170 "**Disconnect Switches**" for disconnect switches for powered operators.

1.3 DEFINITIONS

A. **Operation Cycle**: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

A. **Structural Performance**: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.

B. **Operation-Cycle Requirements**: Design sectional overhead door components and operator to operate for not less than 10,000 cycles.

1.5 SUBMITTALS

A. **Product Data**: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
   1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
   2. Summary of forces and loads on walls and jambs.
   3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. **Shop Drawings**: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
   1. Furnish custom details demonstrating conformance to conditions indicated on Drawings.
   2. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

C. **Samples for Selection**: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.

1.6 QUALITY ASSURANCE

A. **Installer Qualifications**: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

B. **Manufacturer Qualifications**: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

C. **Source Limitations**: Obtain sectional overhead doors through one source from a single manufacturer.
   1. Obtain operators and controls from the sectional overhead door manufacturer.

D. **Product Options**: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."

E. **Listing and Labeling**: Provide electrically operated fixtures specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design:** Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
   1. Manufacturer: Overhead Door Corporation.
   2. Products:
      a. Exterior Insulated Steel Doors: Thermacore Model 596.

B. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Clopay Building Products Co.
   2. General American Door Co.
   3. McKee Door, Inc.; a United Dominion Company.
   4. Overhead Door Corporation.
   5. Raynor Garage Doors.
   6. Wayne-Dalton Corp.

2.2 STEEL SECTIONS

A. **Door Assembly**: Metal/foam/metal sandwich panel construction, with PVC thermal break and weather-tight ship-lap design meeting joints.
   1. Panel Thickness: 2 inches.
   2. Exterior Surface: Flush, textured.
   3. Exterior Steel: Nominal 20 gauge, hot-dip galvanized.
   4. End Stiles: 16 gage with thermal break.

B. **Insulation**: CFC-free and HCFC-free polyurethane, fully encapsulated: R-value of 17.4; U-value of 0.057.

C. **Air Infiltration**: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.

D. **Glazing**: 1/2 inch tempered insulating glass in full aluminum sash panels.

E. **Finish and Color**: Two coat baked-on polyester or epoxy; custom colors as selected by Architect.

F. **Operation**: Motorized.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. **Tracks**: Provide manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches on center for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

B. **Track Reinforcement and Supports**: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. **Support and attach tracks** to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. **Weatherseals**: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.
   1. In addition, provide continuous flexible seals at door jambs for a weathertight and sound-tight installation.
   2. Provide doors with manufacturer's energy conservation package of seals, including side and top seals and bottom gasket.

E. **Windows**: Provide windows of type and size indicated and in arrangement shown. Set glazing in vinyl, rubber, or neoprene glazing channel for metal-framed doors, as required. Provide removable stops of same material as door section frames.
   1. Size: Manufacturer's standard panel for type of glazing indicated.

F. **Insulating-Glass Units**: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units.
   1. Provide Kind FT (fully tempered) 1/2 inch insulated glass lites.
   2. Overall Unit Thickness: 1/2 inch.
   3. Thickness of Each Lite: 1/8 inch.
   4. Interspace Content: Air.
   5. Sealing System: Dual seal, with primary and secondary sealants as follows:
      a. Manufacturer's standard sealants.
   6. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
      a. Spacer Material: Aluminum with mill or clear anodic finish.
      b. Desiccant: Molecular sieve or silica gel, or blend of both.
      c. Corner Construction: Manufacturer's standard corner construction.

2.4 HARDWARE

A. **General**: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. **Hinges**: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch- thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

C. **Rollers**: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch track, 2-inch- diameter roller tires for 2-inch track, and as follows:
   1. Neoprene or bronze tires.

D. **Push/Pull Handles**: For emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. **Pull Rope**: Black nylon cable.

F. **Locks**: Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
   1. Locking Bars: Single-jamb side, operable from inside only.
   2. Lock cylinder is specified in another Division 8 Section.

G. **Power Operated Doors**: Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.5 COUNTERBALANCING MECHANISM

A. **Torsion Spring**: Operation by torsion-spring counterbalance mechanism consisting of adjustable-tension torsion springs, fabricated from oil-tempered-steel wire complying with ASTM A 229, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for 50,000 cycles minimum.

B. **Bracket**: Provide anchor support bracket, as required to connect stationary end of spring to the wall, to level shaft and prevent sag.

C. **Spring Bumper**: Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

D. **Lift/Pull Operation:** Design counterbalance mechanism so required lift/pull operation does not exceed 25 lbf.

2.6 ELECTRIC DOOR OPERATORS

A. **General**: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. **Comply** with **NFPA 70**.

C. **Disconnect Device**: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. **Design operator** so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. **Provide control equipment** complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. **Door-Operator Type**: Provide unit consisting of electric motor and the following:
   1. Jackshaft type, with V-belt primary reduction, chain intermediate reduction, roller chain drive connected to counterbalance shaft, and floor-level disconnect-release for manual operation.

G. **Electric Motors**: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.
   1. Type: Polyphase, medium-induction type.
   2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
   3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
   4. Provide open drip-proof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
   5. Provide totally enclosed, non-ventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

H. **Obstruction Detection Devices**: Provide each motorized door with indicated external automatic safety sensors able to protect full width of door opening. Activation of sensors immediately stops and reverses downward door travel.
   1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
      a. Self-Monitoring Type: Provide self-monitoring sensor designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door operates to close only with constant pressure on close button.
   2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Provide electrically actuated automatic bottom bar.
         1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

I. **Limit Switches**: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine wall and overhead areas**, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. **General**: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. **Fasten vertical track** assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

A. **Lubricate bearings and sliding parts**; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

B. **Adjust belt-driven motors** as follows:
1. Use adjustable motor-mounting bases for belt-driven motors.
2. Align pulleys and install belts.
3. Tension belt according to manufacturer's written instructions.

C. **Affix NO stickers** to doors or tracks except required safety warnings.

3.4 CLEANING AND ADJUSTING

A. **Adjust door assembly** to smooth operation and in full contact with weatherstripping.

B. **Clean** doors, frames and glass.

C. **Remove temporary labels** and visible markings.

3.5 PROTECTION

A. **Do not permit construction traffic** through overhead door openings after adjustment and cleaning.

B. **Protect** installed products until completion of project.

C. **Touch-up, damaged coatings and finishes** and repair minor damage before Substantial Completion.

3.6 DEMONSTRATION

A. **Startup Services**: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION

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SECTION 08 4113

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following types of aluminum entrance and storefront work:
   1. Interior storefront framing.
   2. Interior manual-swing entrance doors and door-frame units.

B. **Related Sections**: The following sections contain requirements that relate to this Section:
   1. Section 07 9200 "**Joint Sealants**" for sealing between storefront system and the substrate.
   2. Section 08
   2. Section 08 8000 "**Glazing**" for requirements for aluminum entrances and storefront, including entrances specified to be factory glazed.
   3. Section 08 7100 "**Door Hardware**" for door hardware to be installed on aluminum doors, except items noted specifically by aluminum door manufacturer. **Installation** of aluminum door hardware shall be **by Aluminum contractor.**

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. **General**: Provide aluminum entrance and storefront assemblies that comply with performance characteristics specified, as demonstrated by testing the manufacturer's corresponding stock assemblies according to test methods indicated.

B. **Thermal Movement**: Design the aluminum entrance and storefront framing systems to provide for expansion and contraction of the component materials. Entrance doors shall function normally over the specified temperature range.
   1. The system shall be capable of withstanding a metal surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects.

C. **Design Requirements**: Provide aluminum entrance and storefront systems that comply with structural performance, air infiltration, and water penetration requirements indicated.

D. **Structural Performance**: Conduct tests for structural performance in accordance with ASTM E 330. At the conclusion of the tests there shall be no glass breakage or permanent damage to fasteners, anchors, hardware or actuating mechanism. Framing members shall have no permanent deformation in excess of 0.2 percent of their clear span.
   1. Deflection Normal to the Plane of the Wall: Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the wind load specified above. Deflection shall not exceed 1/175 of the clear span, when subjected to uniform load deflection test.
   2. Deflection Parallel to the Plane of the Wall: Test pressures required to measure deflection parallel to the plane of the wall shall be equal to 1.5 times the wind

pressures specified above. Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75 percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other fixed member above to less than 1/8 inch. The clearance between the member and an operable door or window shall be at least 1/16 inch.

E. **Air Infiltration**: Provide aluminum entrance and storefront framing system with an air infiltration rate of not more than 0.06 CFM per sq. ft. of fixed area (excluding operable door edges) when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.57 psf.

1.4 SUBMITTALS

A. **Product Data:** Product data for each aluminum entrance and storefront system required, including:
1. Manufacturer's standard details and fabrication methods.
2. Data on finishing, hardware and accessories.
3. Recommendations for maintenance and cleaning of exterior surfaces.

B. **Shop Drawings:** Shop drawings for each aluminum entrance and storefront system required, including:
1. Layout and installation details, including relationship to adjacent work.
2. Elevations at 1/4-inch scale.
3. Detail sections of typical composite members.
4. Anchors and reinforcement.
5. Hardware mounting heights.
6. Provisions for expansion and contraction and for draining moisture occurring within the assembly to the exterior.
7. Glazing details.
8. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

C. **Samples for Color Selection**: Submit pairs of samples of each specified color and finish on 12-inch-long sections of extrusions or formed shapes. Where normal color variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of color variations.

D. **Delegated-Design Submittal**: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. **Test Reports**: Provide certified test reports from a qualified independent testing laboratory showing that aluminum entrance and storefront systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.5 QUALITY ASSURANCE

A. **Installer Qualifications**: Engage an experienced Installer who has completed installations of aluminum storefront and entrances similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

B. **Manufacturer's Qualifications**: Provide aluminum entrances and storefront systems produced by a firm experienced in manufacturing systems that are similar to those indicated for this project and that have a record of successful in-service performance.

C. **Single Source Responsibility**: Obtain aluminum entrance and storefront systems from one source and from a single manufacturer.

D. **Design Criteria**: The drawings indicate the size, profile, and dimensional requirements of aluminum entrance and storefront work required and are based on the specific types and models indicated. Aluminum entrance and storefront by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Deliver** aluminum entrance and storefront components in the manufacturer's original protective packaging.

B. **Store** aluminum components in a clean dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.
   1. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

1.7 PROJECT CONDITIONS

A. **Field Measurements:** Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work
   1. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1.8 WARRANTY

A. **Special Assembly Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
   1. Failures include, but are not limited to, the following.
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components to function properly.
      f. Warranty Period: Five years from date of Substantial Completion.

2. **Special Finish Warranty:** Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   a. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design:** Contract Documents are based on products listed below to establish a standard of quality. Other available manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
   1. Manufacturer: Kawneer North American, an Arconic Company.
   2. Products:
      a. Storefront System (Interior): Trifab Versaglaze 451.
      c. Entrance Doors and Frames: Heavy Wall 500.

B. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering entrance and storefront systems that may be incorporated in the Work include, but are not limited to, the following:
   1. Kawneer North American, an Arconic Company.
   2. U.S. Aluminum Corp., a division of C.R. Laurence Co., Inc.
   3. EFCO Corporation, an Apogee Enterprises company.
   4. Oldcastle BuildingEnvelope**.**
   5. Manko
   6. Tubelite, an Apogee Enterprises company.

2.2 MATERIALS

A. **Aluminum Members**: Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for aluminum extrusions, ASTM B 209 for aluminum sheet or plate, and ASTM B 211 for aluminum bars, rods and wire.

B. **Carbon Steel**: Carbon steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

C. **Glass and Glazing Materials**: Comply with requirements of "Glass and Glazing" section of these specifications.

D. **Fasteners**: Provide fasteners of aluminum, nonmagnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
   1. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125 inches thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
   2. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware being fastened.

E. **Concealed Flashing**: 0.0179-inch (26 gage) minimum dead-soft stainless steel, or 0.026-inch-thick minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.

F. **Brackets and Reinforcements**: Provide high-strength aluminum brackets and reinforcements; where use of aluminum is not feasible provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

G. **Concrete and Masonry Inserts**: Provide cast iron, malleable iron, or hot-dip galvanized steel inserts complying with ASTM A 123.

H. **Compression Weatherstripping**: Manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.

2.3 DOOR HARDWARE

A. **General:** Refer to Division 8 Section "Door Hardware" for door hardware other than those indicated to be provided by the aluminum entrance manufacturer.

B. **Door hardware for aluminum doors** shall be installed by aluminum door contractor.

2.4 COMPONENTS

A. **Storefront Framing System**: Provide storefront and entrance framing systems fabricated from extruded aluminum members of size and profile indicated. Include subframes and other reinforcing members of the type indicated. Provide for storefront glazed from the exterior on all sides with projecting stops as scheduled. Shop-fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.
   1. Mullion Configurations: Provide pockets at the inside glazing face to receive resilient elastomeric glazing. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior.
   2. Provide with structural silicone glazing (SSG) adaptor where indicated on Drawings.

B. **Entrance Door Frames**: Provide tubular and channel frame entrance door frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards. Reinforce as necessary to support required loads. Entrance doors and frames shall be supplied as a complete system. Frames shall be minimum 3/16 inch wall thickness.

C. **Stile-and-Rail Type Entrance Doors**: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts.
   1. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for nonremoval.
   2. Design: Provide 2-inch-thick doors with minimum 3/16 inch wall thickness.

2.5 FABRICATION

A. **General**: Fabricate aluminum entrance and storefront components to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the drawings. Variable dimensions are indicated, with maximum and minimum dimensions required, to achieve design requirements and coordination with other work.
   1. Thermal-Break Construction: Fabricate exterior storefront framing system with an integrally concealed, low-conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.

B. **Prefabrication**: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
   1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
   2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.

C. **Welding**: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.
   1. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.

D. **Reinforcing**: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.

E. **Dissimilar Metals:** Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.

F. **Continuity**: Maintain accurate relation of planes and angles with hairline fit of contacting members.

G. **Fasteners**: Conceal fasteners wherever possible.

H. **Weather stripping:** At interior doors and other locations without weather stripping, provide neoprene silencers on stops to prevent metal-to-metal contact.

2.6 FINISHES

A. **General**: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. **AA Designations:** Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. **Clear Anodic Finish** - AA-M12C22A41 Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I clear coating 0.7 mils or thicker, complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates and supports**, with the Installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of aluminum entrances and storefronts. Correct unsatisfactory conditions before proceeding with the installation.
   1. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. **Comply with manufacturer's instructions** and recommendations for installation.

B. **General**: Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines and grades indicated. Provide proper support and anchor securely in place.

C. **Construction Tolerances**: Install aluminum entrance and storefront to comply with the following tolerances:
   1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length.
   2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed 1/16 inch.
   3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8 inch.
   4. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch.

D. **Separate aluminum and other corrodible metal surfaces** from sources of corrosion or electrolytic action at points of contact with other materials.
   1. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.
   2. Paint dissimilar metals where drainage from them passes over aluminum.
   3. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating.
   4. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with two coats of aluminum house paint. Seal joints between the materials with sealant.

E. **Drill and tap frames and doors** and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

F. **Set sill members** and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.

G. Refer to **Division 8** Section "**Glazing**" for installation of glass and other panels indicated to be glazed into doors and framing, and not preglazed by aluminum manufacturer.

3.3 ADJUSTING

A. **Adjust operating hardware** to function properly, for smooth operation without binding, and for weathertight closure.

3.4 CLEANING

A. **Clean the completed system**, inside and out, promptly after installation, exercising care to avoid damage to coatings.

B. **Clean glass surfaces after installation**, complying with requirements contained in the "Glass and Glazing" Section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.5 PROTECTION

A. **Institute protective measures** required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Interior borrowed lites and glazed entrances.

1.3 DEFINITIONS

A. **Manufacturer**: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. **Interspace**: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. **Deterioration of Coated Glass**: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. **Deterioration of Insulating Glass**: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. **General**: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. **Glass Design**: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.4.2, "Analytic Procedure," based on mean roof heights above grade indicated on Drawings.
   b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads."
   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      1) Load Duration: 60 seconds or less.
   d. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
   e. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
   f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. **Thermal Movements**: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

D. **Thermal and Optical Performance Properties**: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- wide interspace.
3. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F.
4. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
5. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. **Product Data:** For each glass product and glazing material indicated.

B. **Samples**: For the following products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
   1. Each color of tinted float glass.
   2. Coated vision glass.
   3. Insulating glass for each designation indicated.
   4. For each color (except black) of exposed glazing sealant indicated.

C. **Glazing Schedule**: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. **Product Certificates**: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. **Preconstruction Adhesion and Compatibility Test Report**: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

F. **Product Test Reports**: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
   1. Tinted float glass.
   2. Coated float glass.
   3. Insulating glass.
   4. Glazing sealants.
   5. Glazing gaskets.

G. **Warranties**: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. **Installer Qualifications**: : An experienced installer who has completed glazing similar in material, design and extent to that indicated for this project; whose work has resulted in glass installations with a record of successful in-service performance.

B. **Source Limitations for Clear Glass**: Obtain clear float glass from one primary-glass manufacturer.

C. **Source Limitations for Tinted Glass:** Obtain tinted, heat-absorbing, and light-reducing float glass from one primary-glass manufacturer for each tint color indicated.

D. **Source Limitations for Coated Glass**: Obtain coated glass from one manufacturer for each type of coating and each type of class of float glass indicated.

E. **Source Limitations for Insulating Glass**: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.

F. **Source Limitations for Glazing Accessories**: Obtain glazing accessories from one source for each product and installation method indicated.

G. **Glass Product Testing:** Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

H. **Elastomeric Glazing Sealant Product Testing**: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

I. **Preconstruction Adhesion and Compatibility Testing**: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glass type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
      a. Perform tests under normal environmental conditions replicating those that will exist during installation.
   2. Submit not fewer than nine pieces of each type and finish of glass-framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, and insulating units) as well as one sample of each glazing accessory (gaskets, tape sealants, setting blocks, and spacers).
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
   5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

J. **Safety Glass**: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
   1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

K. **Glazing Publications:** Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

L. **Dual Seal Certification Program**: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.
   3. National Accreditation and Management Institute.

M. **Provide a signed and dated certificate** for the installed fenestration system listing the assembly U-factor, the solar heat gain coefficient and the air leakage rate. This is to meet the exception to the Labeling of Fenestration Products under Item 5.8.2.2 of the ANSI/ASHRA/IESNA STANDARD 90.1-2004.
   1. Fenestration systems shall have a maximum assembly U value of 0.44 and a minimum SHGC of 0.42.

N. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. **Protect glazing materials** according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. **For insulating-glass units** that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

1.9 WARRANTY

A. **General Warranty**: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Manufacturer's Special Warranty on Coated-Glass Products**: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. **Manufacturer's Special Warranty on Insulating Glass**: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. **Available Products**: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

A. **Float Glass**: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

A. **Fabrication Process**: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. **Heat-Treated Float Glass:** ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 COATED FLOAT GLASS

A. **General:** Provide coated glass complying with requirements indicated in this Article and in schedules at the end of Part 3.
1. Provide Kind HS (heat-strengthened) coated float glass in place of coated annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. **Sputter-Coated Float Glass**: Float glass with metallic-oxide or metallic-nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), complying with requirements specified in schedules at the end of Part 3.

2.5 INSULATING GLASS

A. **Insulating-Glass Units**: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. **Overall Unit Thickness and Thickness of Each Lite**: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. **Sealing System**: **Dual seal**, with primary and secondary sealants as follows:
1. Primary Seal: Polyisobutylene.
2. Secondary Seal: Silicone.

D. **Spacer Specifications**: Manufacturer's standard spacer material and construction complying with the following requirements:
1. Aluminum with mill or clear-anodized finish.
2. Desiccant: Molecular sieve or silica gel, or blend of both.
3. Corner Construction: Manufacturer's standard corner construction.

2.6 ELASTOMERIC GLAZING SEALANTS

A. **General**: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

B. **Elastomeric Glazing Sealant Standard**: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

C. **Glazing Sealant for Fire-Resistive Glazing Products**: Identical to product used in test assembly to obtain fire-protection rating.

2.7 GLAZING TAPES

A. **Back-Bedding Mastic Glazing Tape**: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. **Expanded Cellular Glazing Tape**: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 1, for glazing applications in which tape acts as the primary sealant.
   2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 GLAZING GASKETS

A. **Soft Compression Gaskets**: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   3. Silicone.
   4. Thermoplastic polyolefin rubber.
   5. Any material indicated above.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. **General:** Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. **Cleaners, Primers, and Sealers**: Types recommended by sealant or gasket manufacturer.

C. **Setting Blocks**: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. **Spacers**: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. **Edge Blocks**: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. **Cylindrical Glazing Sealant Backing**: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. **Fabricate glass** and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. **Clean-cut or flat-grind vertical edges** of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. **Grind smooth** and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine framing glazing**, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. **Proceed with installation** only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Clean glazing channels** and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. **Comply with combined written instructions** of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. **Glazing channel dimensions**, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. **Protect glass edges** from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. **Apply primers** to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. **Install setting blocks** in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. **Do not exceed edge pressures** stipulated by glass manufacturers for installing glass lites.

G. **Provide spacers** for glass lites where the length plus width is larger than 50 inches (as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. **Provide edge blocking** where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. **Set glass lites** in each series with uniform pattern, draw, bow, and similar characteristics.

J. **Where wedge-shaped gaskets are driven into one side of channel** to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. **Square cut wedge-shaped gaskets** at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. **Position tapes** on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. **Install tapes continuously**, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. **Where framing joints are vertical**, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. **Place joints in tapes** at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. **Do not remove release paper** from tape until just before each glazing unit is installed.

F. **Apply heel bead** of elastomeric sealant.

G. **Center glass lites in openings** on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. **Apply cap bead** of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. **Fabricate compression gaskets** in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. **Insert soft compression gasket** between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. **Center glass lites in openings** on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. **Install gaskets** so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. **Install continuous spacers**, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. **Force sealants** into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. **Tool exposed surfaces** of sealants to provide a substantial wash away from glass.

3.7 PROTECTION AND CLEANING

A. **Protect exterior glass** from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. **Protect glass from contact with contaminating substances** resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. **Examine glass surfaces** adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. **Remove and replace** glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. **Wash glass on both exposed surfaces** in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.8 MONOLITHIC FLOAT-GLASS SCHEDULE

A. **TYPE 'C'** - 1/4 inch float glass.

B. **Uncoated Clear Float Glass**: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
   1. Uncoated Clear Annealed Float Glass: Annealed or Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with performance requirements.
   2. Uncoated Clear Heat-Strengthened Float Glass: Kind HS (heat strengthened).
   3. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered). Provide as required and as indicated.

3.9 INSULATING-GLASS SCHEDULE

A. **TYPE A: Solar-Control Low-E Insulating-Glass Units**:
   1. Where glass of this designation is indicated, provide insulating-glass units complying with the following:
      a. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
         1) Manufacturer: Vitro Architectural Glass
         2) Products:
            (a) Outdoor Lite: Clear (transparent) float.
            (b) Low-E Coating: Solarban 60.
            (c) Indoor Lite: Clear (transparent) float.
      b. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of the following manufacturers. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections.
         1) Vitro Architectural Glass
         2) Guardian.
   2. Overall Unit Thickness: 1 inch (25mm).
   3. Thickness of Each Lite: 1/4 inch (6mm).
   4. Interspace Content: Air.
   5. Outdoor Lite: Class 1 (clear) float glass with Solarban 60.
      a. Provide HS (heat strengthened) or FT (fully tempered) glass as indicated on the drawings. If FT (fully tempered) glass is not indicated on the drawings; but is required by the governing code, provide FT (fully tempered) glass.
   6. Indoor Lite: Class 1 (clear) float glass.
      a. Provide HS (heat strengthened) or FT (fully tempered) glass as indicated on the drawings. If FT (fully tempered) glass is not indicated on the drawings; but is required by the governing code, provide FT (fully tempered) glass.
   7. Low-E Coating: Sputtered on second surface.
   8. Visible Light Transmittance: 70 percent minimum.
   9. Winter Nighttime U-Factor: 0.29 maximum (air infill).
   10. Solar Heat Gain Coefficient: 0.39 maximum.
   11. Outdoor Visible Reflectance: 11 percent maximum.

3.12 GLAZING SEALANT SCHEDULE

A. **Low-Modulus Nonacid-Curing Silicone Glazing Sealant**:
   1. Products: Available products include the following:
      a. 790; Dow Corning.
      b. UltraPruf SCS2300; GE Silicones.
      c. Spectrem 1; Tremco.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
   5. Use Related to Exposure: NT (nontraffic).
   6. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
      a. Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.

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DIVISION 09 - FINISHES

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SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes non-load-bearing steel framing** members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. **Related Sections** include the following:
   1. Section 07 2100 "**Building Insulation**" for insulation installed in between framing members.

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. **Fire-Test-Response Characteristics**: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. **STC-Rated Assemblies**: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. **Design framing systems** in accordance with American Iron and Steel Institute Publication “S220 - North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members”, except as otherwise shown or specified.

D. **Code-Compliance Certification of Studs and Tracks:** Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. **Framing Members, General**: Comply with ASTM C 645 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
   2. Protective Coating: ASTM A 653, G40, Coating with equivalent corrosion resistance of ASTM A 653, G40 or DiamondPlus® coating; roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. [G60]. Galvannealed products are not acceptable.
      a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authorities having jurisdiction.

2.2 SUSPENSION SYSTEM COMPONENTS

A. **Tie Wire**: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 16 gauge (0.0625-inch-) diameter wire, or double strand of 18 gauge (0.0475-inch) diameter wire.

B. **Hanger Attachments to Concrete**:
   1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. **Wire Hangers**: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. **Flat Hangers**: Steel sheet, minimum 1 by 3/16 inch by length indicated.

E. **Carrying Channels**: Cold-rolled, commercial-steel sheet with a base-steel thickness of 16 gauge (0.0538 inch) and minimum 1/2-inch- wide flanges.
   1. Depth: Minimum 1-1/2 inches.

F. **Furring Channels (Furring Members)**:
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
      a. Minimum Base Steel Thickness: Minimum 20 gauge (0.0296 inch).
   2. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
      a. Equal to: RC Deluxe (RCSD) Resilient Channel by ClarkDietrich Building Systems or RSIC-1 as manufactured by PAC International, Inc.

G. **Grid Suspension System for Ceilings**: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation.
      c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. **Steel Studs and Runners**: ASTM C 645.
   1. Minimum Base-Steel Thickness: Minimum 20 gauge (30 mil or 0.0296 inch).

B. **Slip-Type Head Joints**:
   1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Available Products: Subject to compliance with requirements of Contract Documents, products that may be incorporated into the Work include, but are not limited to, the following:
         1) Steel Network Inc. (The); VertiClip SLD/VertiTrack VTD Series.
         2) ClarkDietrich Building Systems; BlazeFrame DSL or MaxTrak Slotted Track, depending on wall rating.

C. **Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.**
   1. Product: ClarkDietrich Building Systems; Danback Fire-Retardant Treated Wood Backing Plate D16F or D24F, per spacing noted, or a comparable product.

D. **Flat Strap Backing Plate**: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Steel Thickness: Minimum 16 gauge.

E. **Cold-Rolled Channel Bridging**: **16 gauge** base-steel thickness, with minimum 1/2-inch wide flanges.
   1. Product: ClarkDietrich Building Systems; Cold-Formed U-Channel and EasyClip U-Series Angle (U543,U545 or U547, as required, or a comparable product.
   2. Depth: Minimum 1-1/2 inches.
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 16 gauge (0.0538 inch) thick, galvanized steel.

F. **Hat-Shaped, Rigid Furring Channels**: ASTM C 645.
   1. Minimum Base Steel Thickness: Minimum 20 Gauge (0.0296 inch).
   2. Depth: 7/8 inch.

G. **Resilient Furring Channels**: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
   1. Equal to: RC Deluxe (RCSD) Resilient Channel by ClarkDietrich Building Systems, or RSIC-1 as manufactured by PAC International, Inc.

H. **Cold-Rolled Furring Channels**: 16 gauge (0.0538 inch) base-steel thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: Minimum 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum base-steel thickness of 20 gauge (0.0296 inch).
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062 inch diameter wire, or double strand of 0.0475-inch- diameter wire.

I. **Z-Shaped Furring**: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 3/4 inch, minimum base-steel thickness of 25 gauge (0.0179 inch), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. **General**: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. **Sill Sealer for Exterior Steel Stud Walls**: Refer to section 05 4200 “Cold-Formed Metal Framing”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine areas and substrates**, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. **Installation Standard**: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. **Blocking**: Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, cabinets and casework, or similar construction.

C. **Bracing**: Install bracing at terminations in assemblies.

D. **Expansion Joints**: Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING SUSPENSION SYSTEMS

A. **Install suspension system** components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

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 referenced installation standards.
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. **Fire-Resistance-Rated Assemblies**: Wire tie furring channels to supports.

E. **Seismic Bracing**: Sway-brace suspension systems with hangers used for support.

F. **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.

G. **Installation Tolerances**: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.4 INSTALLING FRAMED ASSEMBLIES

A. **Where studs are installed directly against exterior masonry walls** or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. **Install studs** so flanges within framing system point in same direction.

C. **Install tracks** (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb or provide 16 gauge studs at door openings, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. **Direct Furring**:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center

E. **Z-Furring Members**:
1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches on center
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches on center
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. **Tackable Surface**: Provide back to back pairs of studs at 48 inches on center, spaced symmetrically from the centerline of the wall. Stud pairs when not coincident with wall framing studs may be terminated and headered 6 inches above the ceiling.

END OF SECTION

SECTION 09 2903

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section include**s the following:
1. Interior gypsum board.
2. Glass mat tile backing panels - interior.
3. Aluminum trim.

B. **Related Sections** include the following:
1. Section 07 2100 "**Building Insulation**" for insulation installed in assemblies that incorporate gypsum board.
2. Section 07 9200 "**Joint Sealants**" for acoustical sealants installed in assemblies that incorporate gypsum board.
3. Section 09 2216 "**Non-Structural Metal Framing**" for non-structural framing and suspension systems that support gypsum board.
4. Section 09 9123 "**Painting**" for **primers** applied to gypsum board surfaces.

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated.

B. **Samples**: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. **Fire-Resistance-Rated Assemblies**: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. **STC-Rated Assemblies**: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. **Store materials** inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. **Environmental Limitations**: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. **Do not install interior product**s until installation areas are enclosed and conditioned.

C. **Do not install panels** that are wet, those that are moisture damaged, and those that are 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 PANELS, GENERAL

A. **Size**: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Gypsum Co.
   2. G-P Gypsum.
   3. National Gypsum Company.
   4. USG Corporation.

B. **Gypsum Board, Type X:** ASTM C1396/C 1396M
   1. Thickness: 5/8 inch - for use at standard wall conditions.
   2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. **Glass-Mat, Water-Resistant Backer Units**:
   1. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products which may be incorporated into the work include, but are not limited to, the following:
      a. "DensShield Tile Backer" by Georgia-Pacific Gypsum.
      b. "Gold Bond e2XP Tile Backer" by National Gypsum.

B. **Properties:**
   1. Comply with ASTM C 1178/C 1178M.
   2. Core: 5/8 inch, Type X.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.
   4. Provide glass-mat, water-resistant backing board wherever tile is applied to a stud wall.

2.4 TRIM ACCESSORIES

A. **Interior Trim**: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. 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. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. **Aluminum Trim:** Extruded accessories of profiles and dimensions indicated.
   1. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. **General:** Comply with ASTM C 475/C 475M.

B. **Joint Tape**:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. **Joint Compound for Interior Gypsum Wallboard**: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. **Joint Compound for Tile Backing Panels**:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.6 AUXILIARY MATERIALS

A. **General:** Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. **Laminating Adhesive:** Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. **Steel Drill Screws**: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. **Acoustical Sealant:** As specified in Division 7 Section "Joint Sealants."

E. **Thermal Insulation:** As specified in Division 7 Section "Building Insulation."

F. **Vapor Retarder:** As specified in Division 7 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine areas and substrates**, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

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 APPLYING AND FINISHING PANELS, GENERAL

A. **Comply** with **ASTM C 840**.

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 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. 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- wide joints to install sealant.

G. **Isolate perimeter** of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. **Install interior gypsum board** in the following locations:
   1. Type X: Vertical surfaces, unless otherwise indicated.

B. **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 partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. **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 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-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.

4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. **Laminating to Substrate**: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

A. **Glass-Mat,** Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. **Where tile backing panels abut other types of panels** in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING 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:** Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. **Interior Trim**: Install in the following locations:
1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. **Aluminum Trim:** Install in locations indicated on Drawings.

E. **Install corner beads** at external corners. Provide metal trim to protect edge of gypsum board wherever gypsum board intersects a dissimilar material. Hold channel and L trim back from metal window and door frames 1/8 inch to allow for caulking.

3.6 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 those with trim having flanges not intended for tape.

D. **Gypsum Board Finish Levels:** Finish panels to levels indicated below:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile and panels that are substrate for CMU wainscot.
   3. Level 3: Panels that are substrates for wall coverings and wall panels.
   4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
   5. Level 5: In areas with oblique lighting such as corridors with a window at the end, lobby walls that end at windows. Also, on walls to receive deep tone paints or paints with a gloss level higher than "flat".
      a. Primer and its application to surfaces are specified in other **Division 9** Sections.

E. **Glass-Mat, Water-Resistant Backing Panels**: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. **Protect installed products** from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. **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.

3.8 FIELD QUALITY CONTROL

A. **Above-Ceiling Observation:** Architect will conduct an above-ceiling observation before installing gypsum board ceilings and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of ceiling support framing.

END OF SECTION

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SECTION 09 3013

CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** the following:
1. Porcelain floor tile.
2. Glazed wall tile.
3. Wall accent tile.

B. **Related Sections** include the following:
1. Section 07 9200 "**Joint Sealants**" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 2900 "**Gypsum Board**" for tile backing panels installed in gypsum wallboard assemblies.

1.3 DEFINITIONS

A. **Module Size**: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. **Facial Dimension**: Nominal tile size as defined in ANSI A137.1.

1.4 SUBMITTALS

A. **Product Data**: For each type of tile, mortar, grout, and other products specified.

B. **Tile Samples for Selection**: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

C. **Grout Samples for Selection**: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

1.5 QUALITY ASSURANCE

A. **Installer Qualifications**: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. **Source Limitations for Tile**: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. **Source Limitations for Setting and Grouting Materials**: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. **Source Limitations for Other Products**: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
   1. Solid Surface Material thresholds.
   2. Waterproofing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Deliver and store** packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. **Prevent damage** or contamination to materials by water, freezing, foreign matter, and other causes.

C. **Handle tile** with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

A. **Deliver extra materials to Owner**. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
   1. Tile Products:
      a. American Olean Tile Company.
      b. Dal-Tile Corporation.
      c. United States Ceramic Tile Company.

2. Tile-Setting and -Grouting Materials:
   a. Laticrete International, Inc.
   b. Mapei Corporation.
   c. Custom Building Products.

2.2 PRODUCTS, GENERAL

A. **ANSI Ceramic Tile Standard**: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. **ANSI Standards for Tile Installation Materials**: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. **Colors, Textures, and Patterns**: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated. Also see the Finish Schedule.
   2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. **Factory Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. **Mounting**: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.

F. **Factory-Applied Temporary Protective Coating**: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. **Porcelain Mosaic Floor Tile**: Provide factory-assembled sheets of flat tile complying with the following requirements:
   1. Composition: Colorbody Porcelain.
   2. Module Size: 2 x 2 inches, as indicated on Key-Finish Schedule.
   3. Nominal Thickness: 5/16 inch.
   4. Face: Plain with square or cushion edges.

5. Surface: Unpolished.
6. Color: As listed in the Finish Schedule and as shown on drawings. If not indicated then as selected by the Architect from series indicated.
7. Available Products:
   a. As listed in the Key-Finish Schedule.

B. **Porcelain Wall Tile**: Provide flat tile complying with the following requirements:
1. Composition: Porcelain.
2. Module Size: 12 x 24 inches and as scheduled.
3. Nominal Thickness: 5/16 inch.
4. Face: Plain with square or cushion edges.
5. Surface: Unpolished.
6. Color: As listed in the Key-Finish Schedule and as shown on Drawings. If not indicated then as selected by the Architect from series indicated.

C. **Glazed Ceramic Wall Tile**: Provide flat tile complying with the following requirements:
1. Field Tile: Module size - 4 x 4 inches as indicated in the Finish Schedule or if not listed then as selected by the Architect from Price Group I.
2. Thickness: 5/16 inch.
3. Face: Plain with cushion edges.
4. Colors: As listed in the Key-Finish Schedule and shown on the drawings.
7. Accents: Multiple colors and accents may be used, including deep colored units.

D. **Trim Units**: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Base for Portland Cement Mortar Installations: Coved.
   b. Base for Thin-Set Mortar Installations: Straight.
   c. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   d. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   e. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

2.4 METAL TRIMS

A. **Acceptable Manufacturer:** Subject to compliance with requirements of Contract Documents, provide products as indicated on Drawings or as directed by Architect by the following manufacturer:
1. Schluter Systems LP

B. **Properties**:
1. Material: Aluminum.
2. Shapes: Transitions from wall to floor, wainscot caps, vertical edges, and other locations as directed by Architect.
3. Finish: Anodized aluminum to match door hardware.

2.5 SETTING MATERIALS

A. **Polymer-Modified Thinset Mortar:** Meet or exceed ANSI A118.4, A118.11, A118.15E and ISO C2ES1P1.
   1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
      a. Manufacturer: Mapei; www.mapei.com
   b. Product: "UltraFlex 3". 2. Protection:
      a. Install only at temperatures between 40 degrees F and 95 degrees F.
      b. Protect from traffic for 24 hours. Protect from heavy traffic for 7 days.
      c. Protect from frost and rain for 21 days.
      d. Protect from water immersion for 21 days.

B. **Polymer-Enriched Large and Heavy Tile Mortar**: A118.4HTE, A118.11 and A118.15HTE.
   1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
      a. Manufacturer: Mapei; www.mapei.com
      b. Product: "Large Tile and Stone Mortar".
   2. Protection:
      a. Do not disturb the installation, allow light traffic or grout the tiles for at least 24 to 48 hours.
      b. Protect the installation from general traffic for at least 72 hours and from heavy traffic for at least 7 days.
      c. Protect the installation from rain for 72 hours and from freezing for 21 days.

C. **Thick-Set Mortar**: ANSI A108.1A; p
   1. Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
      a. Manufacturer: Mapei; www.mapei.com
      b. Product: "Modified Mortar Bed".
   2. Properties: Pre-blended cement-based, polymer-modified thick bed mortar.
   3. Protection:
      a. Provide for dry, heated storage on site and deliver materials at least 24 hours before work begins.
      b. Protect the installation from rain, snow, freezing and direct solar heat, which may affect curing and performance properties.
      c. Maintain a temperature between 45 degrees F and 95 degrees F for at least 72 hours after the installation.
      d. Because temperature and humidity (during and after installation of tile) affect the final curing time, allow for extended periods of protection when jobsite temperatures drop below 60 degrees F and/or when relative humidity is higher than 70 percent.

e. If Modified Mortar Bed is being used to install tile, allow it to cure for 24 hours per 1/2 inch of thickness. Curing time depends upon thickness applied and jobsite conditions.
f. When installing per ANSI A108.1B, cover the mortar bed for an initial 24 hours.

2.6 GROUTING MATERIALS

A. **Latex-Portland Cement Grout**: Meets or exceeds ANSI A118.3 and A118.6.
1. Basis of Design: Basis of Design: Contract Documents are based on product specified below to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
a. Manufacturer: Mapei; www.mapei.com
b. Product: Mapei Flexcolor CQ.
2. Protection:
a. Use only at temperatures between 50 degrees F and 95 degrees F.
b. Provide for dry, heated storage on site and deliver materials at least 24 hours before tilework begins.
c. For at least 72 hours after completion, protect from rain and freezing, and do not immerse the installation in water.
d. Floors: Keep the installation free from foot traffic for at least 24 hours after grouting.
e. Walls: Protect the installation from impact, vibration and hammering on adjacent and opposite walls for 14 days after tile installation (see the TDS of the adhesive or setting system for details).
f. Because temperature and humidity (during and after installation of tile) affect the final curing time of all cement-based materials, allow for extended periods of curing and protection when temperatures drop below 60 degrees F or when the relative humidity is higher than 70 percent.
3. Colors: As indicated on Key-Finish Legend or, if not indicated, as selected by Architect from manufacturer's full range of colors.

2.7 ELASTOMERIC SEALANTS

A. **General**: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. **Colors**: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. **One-Part, Mildew-Resistant Silicone Sealant**: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

D. **Multipart, Pourable Urethane Sealant for Use T**: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

E. **Available Products**: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
   1. One-Part, Mildew-Resistant Silicone Sealants:
      a. Dow Corning 786; Dow Corning Corporation.
      b. Sanitary 1700; GE Silicones.
      c. Pecora 898 Sanitary Silicone Sealant; Pecora Corp.
      d. Tremsil 600 White; Tremco, Inc.
   2. Multipart, Pourable Urethane Sealants:
      a. Chem-Calk 550; Bostik.
      b. Vulkem 245; Mameco International, Inc.
      c. NR-200 Urexpan; Pecora Corp.
      d. THC-900; Tremco, Inc.

2.8 MISCELLANEOUS MATERIALS

A. **Tile Cleaner**: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

B. **Grout Sealer**: Solvent-based, no-sheen, natural-look penetrating sealer for all sanded and non-sanded grout joints.

2.9 MIXING MORTARS AND GROUT

A. **Mix mortars** and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. **Add materials and additives in accurate proportions**. Do not use or add any water to mortar or grout when mixing, use only latex additive.

C. **Obtain and use type of mixing equipment,** mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
   3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. **Do not proceed** with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Remove coatings**, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. **Blending**: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. **ANSI Tile Installation Standards**: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. **TCNA Installation Guidelines**: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. **Accurately form intersections and returns**. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. **Jointing Pattern**: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

E. **Lay out tile wainscots** to next full tile beyond dimensions indicated.

F. **Expansion Joints**: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or if not indicated as recommended by TCNA guidelines, during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

G. **Grout tile to comply** with the requirements of the following tile installation standards:
   1. For ceramic tile grouts (sand-Portland cement, dry-set, commercial Portland cement, and latex-Portland cement grouts), comply with ANSI A108.10.

3.4 WALL TILE INSTALLATION

A. **Install** types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.
   1. Installation Methods:
      a. Tile over glass mat tile backer panels - Interior Surfaces: TCNA W244C Latest Edition.

B. **Joint Widths**: Install tile on walls with the following joint widths:
   1. Wall Tile: 1/16 inch.

C. **Back Buttering**: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   1. Tile wall installations in wet areas, including showers.
   2. Tile wall installations composed of tiles 8 by 8 inches or larger.

D. **Apply two (2) coats of grout sealer** in accordance with manufacturer's printed instructions and recommendations. Remove sealer remaining on the tile within 3 to 5 minutes of application.

3.5 CLEANING AND PROTECTING

A. **Cleaning**: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-Portland cement grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. **Finished Tile Work**: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. **Provide final protection** and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensure tile is without damage or deterioration at the time of Substantial Completion.

D. **When recommended by tile manufacturer**, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

E. **Before final inspection**, remove protective coverings and rinse neutral cleaner from tile surfaces.

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SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. **Section includes** acoustical ceiling tile, suspension system and accessories.

1.3 SUBMITTALS

A. **Product Data:** Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.
   1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

B. **Samples:** Set of 6 x 4 inch square samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.
   1. Set of 12 inch long samples of each exposed runner and molding.

1.3 QUALITY ASSURANCE

A. **Source Limitations:**
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

B. **Fire Performance Characteristics:** Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.
   1. Surface Burning Characteristics: As follows, tested per ASTM E 84.
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 50 or less.
   2. Fire Resistance Ratings: As indicated by reference to design designation in UL "Fire Resistance Directory" or "FM Approval Guide", for floor, roof or beam assemblies in which acoustical ceilings function as a fire protective membrane; tested per ASTM E 119. Provide protection materials for lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

C. **Seismic Standard:** Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

D. **Coordination of Work:** Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.4 DELIVERY, STORAGE, AND HANDLING

A. **Deliver acoustical ceiling units** to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. **Before installing acoustical ceiling units**, permit them to reach room temperature and a stabilized moisture content.

C. **Handle acoustical ceiling units carefully** to avoid chipping edges or damaging units in any way.

1.5 PROJECT CONDITIONS

A. **Space Enclosure**: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy

1.6 COORDINATION

A. **Coordinate layout and installation** of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system, and partition assemblies

1.7 EXTRA MATERIALS

A. **Furnish extra materials** described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Suspension System:
   a. Armstrong World Industries.
   b. Rockfon/Chicago Metallic Corp.
   c. USG/Donn Corp.
2. Acoustical Tile:
   a. Armstrong.
   b. CertainTeed.
   c. USG.
3. Acoustical Sealant:
   a. Tremco Acoustical Sealant; Tremco.
   b. USG Acoustical Sealant; United States Gypsum Co.
   c. Chem-Calk 600; Woodmont Products, Inc.
   d. Pecora Corp; AC 20 FTR Acoustical and Insulation Sealant

2.2 MATERIALS

A. **Acoustical Ceiling Units:**

1. General: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC's as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).
2. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.
3. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

B. **Ceiling Types:**

1. Type ‘B' Ceiling: Armstrong 'Mesa' (683)
   a. Size: 24 x 48 x 3/4 inches
   b. Edge: Square Lay-in.
   c. CAC: 33
   d. LR: 0.85
   e. NRC: 0.60
   f. Recycled Content: 56 percent
   g. Surface Finish: Factory-applied latex paint
   h. ASTM E 1264 Classification: Type III, Form 2, Pattern C E
   i. Color: White.

C. **Metal Suspension System:** Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

1. Finishes and Colors: Provide manufacturer's standard finish for type of system indicated, unless otherwise required. For exposed suspension members and accessories with painted finish, provide color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.
2. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.
3. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, pre-stretched, Class 1 coating, sized so that stress at 3- times hanger design loan (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.
4. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
    a. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
    b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
    c. Provide shadow reveal molding with width of reveal equal to depth of reveal.
    d. Colors of Moldings and Trims: As selected by Architect.
5. Hold-Down Clips: Minimum 24 gauge spring steel, 1-7/16 inches deep x 7/8 inches wide, designed to fit over cross tees. Provide clips spaced symmetrically 2 ft. o.c.
6. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces. Struts will be required at 12 feet on center both ways for all suspended ceilings according to UBC Standard 25-2.
    a. Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) Amstrong; BERC seismic clips.
        2) Chicago Metallic; 1496 Perimeter Clip.
        3) USG; ACM-7 clip.
7. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with pre-finished 15/16-inch- wide metal caps on flanges.
    a. Structural Classification: Heavy-duty system.
    b. End Condition of Cross Runners: Butt-edge type.
    c. Face Design: Flat, flush.
    d. Cap Material: Steel or aluminum cold-rolled sheet.
    e. Cap Finish: Painted in color as selected from manufacturer's full range.

D. **Miscellaneous Materials:**

1. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. **Coordination:** Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
   1. Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination of other work.

B. **Layout:** Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.2 INSTALLATION

A. **General:** Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.

B. **Arrange acoustical units and orient** directionally-patterned units (if any) in manner shown by reflected ceiling plans.
   1. Install tile with pattern running in one direction.

C. **Install suspension systems** to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6 inches from each end and spaced 48 inches along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0". Comply with detail on drawings for seismic bracing.

D. **Secure wire hangers** by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.

E. **Install edge moldings** of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
   1. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.

F. **Install acoustical panels** in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
   1. Paint cut and exposed edges of acoustical tile.
   2. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.3 ADJUST AND CLEAN

A. **Clean exposed surfaces** of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. **Section Includes**:
   1. Resilient base.
   2. Resilient molding accessories.

B. **Related Sections**:
   1. **Legend-Finish** on Drawings for patterns and colors.

1.3 DELIVERY, STORAGE, AND HANDLING

A. **Store resilient products and installation materials in dry spaces** protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.4 FIELD CONDITIONS

A. **Maintain ambient temperatures** within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. **After installation and until Substantial Completion**, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. **Install resilient products after** other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 STANDARD THERMOPLASTIC RUBBER BASE (B1)

A. **Acceptable Manufacturers**: Subject to compliance with requirements of Contract Documents, provide products by manufacturers listed below and as indicated in Key-Finish on Drawings. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 01 sections.
   1. Manufacturer: Mannington Commercial.
   2. Product: Burkebase Type TP

B. **Product Standard**: ASTM F 1861, Type TP (thermoplastic rubber), Group I (solid, homogeneous).
   1. Style and Location: Style B, Cove: Provide in areas with resilient flooring and where indicated on Drawings.

C. **Characteristics:**
   1. Thickness: 0.125 inch.
   2. Height: 4 inches, per schedule.
   3. Lengths: Coils in manufacturer's standard length.
   4. Outside Corners: Preformed, if available in selected colors; job-formed otherwise.
   5. Inside Corners: Job-formed.

D. **Colors**: As selected by Architect from full range of colors – refer to Finish Legend.

2.2 RUBBER MOLDING ACCESSORY

A. **Acceptable Manufacturers**: Subject to compliance with requirements of Contract Documents, provide products by manufacturers listed below and as indicated in Key-Finish on Drawings. Substitutions will not be considered.
   A. Mannnington Commercial.

B. **Description**: Rubber edge products for glue-down applications for tile and carpet transitions.
   1. Profile and Dimensions: As indicated on Drawings.
   2. Locations: Provide molding accessories in areas indicated.
   3. Colors and Patterns: As indicated on Key-Finish Schedule or if not indicated, as selected by Architect from manufacturer’s full range.

2.3 INSTALLATION MATERIALS

A. **Trowelable Leveling and Patching Compounds**: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. **Adhesives**: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. **Proceed with installation only after** unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. **Prepare substrates** according to manufacturer's written instructions to ensure adhesion of resilient products.

B. **Fill cracks, holes, and depressions** in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. **Do not install resilient products** until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. **Immediately before installation**, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. **Comply with manufacturer's written instructions** for installing resilient base.

B. **Apply resilient base** to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. **Install resilient base in lengths as long as practical** without gaps at seams and with tops of adjacent pieces aligned.

D. **Tightly adhere resilient base** to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. **Do not stretch resilient base** during installation.

F. **On masonry surfaces** or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. **Preformed Outside Corners**: Install preformed corners before installing straight pieces.

H. **Job-Formed Corners**:
   1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. **Comply with manufacturer's written instructions** for installing resilient accessories.

B. **Resilient Molding Accessories**: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. **Comply with manufacturer's written instructions** for cleaning and protecting resilient products.

B. **Perform the following operations** immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.

C. **Protect resilient products** from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. **Cover resilient products** subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 6813

CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** modular, fusion-bonded carpet tile.

B. **Related Sections** include the following:
1. "**Key-Finish**" on Drawings for color and pattern selections.
2. Section 09 6520 "**Resilient Wall Base and Accessories**" for resilient wall base and accessories installed with carpet tile.

1.3 REFERENCE STANDARDS

A. **The Carpet and Rug Institute** "Standard for Installation of Commercial Carpet" CRI 104 - September 2015.

1.4 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. **Shop Drawings**: Show the following:
1. Carpet tile type, color, and dye lot.
2. Type of subfloor.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Pile direction.
7. Type, color, and location of insets and borders.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

C. **Samples**: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.

D. **Product Schedule**: For carpet tile. Use same designations indicated on Drawings.

E. **Product Test Reports**: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. **Maintenance Data**: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

G. **Warranty**: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. **Fire-Test-Response Characteristics**: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Provide certification that carpet has been tested to NFPA Standard 253.
   2. Carpet products in corridors, exit enclosures, and exit passageways: Class I (0.45 watt/cm2).
   3. Carpet products in all rooms in Group B occupancy: Class II (0.22 watts/cm2).

C. **Product Options**: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered.

D. **Pre-installation Conference**: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet tile installation including, but not limited to, the following:
   1. Review delivery, storage, and handling procedures.
   2. Review ambient conditions and ventilation procedures.

E. **Mock-ups**: Provide a mock-up for each type of carpet installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Comply** with CRI Standard.

1.6 PROJECT CONDITIONS

A. **Comply** with CRI Standard.

B. **Environmental Limitations**: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. **Do not install carpet tiles** over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.7 WARRANTY

A. **Special Warranty for Carpet Tiles**: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, dimensional stability, and delamination.
   3. Warranty Period: Lifetime Commercial Limited.

1.8 EXTRA MATERIALS

A. **Furnish extra materials** described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. **Products**: Subject to compliance with requirements of Contract Documents, provide products listed below.
   1. Carpet F3: Shaw Contract
      a. Construction: Tufted; textured patterned loop.
      b. Size: 12 x 36 inches.
      c. Fiber Product: Antron® Lumena™ nylon.
      d. Protective treatments: DuraTech®.
      e. Gauge: 1/12.
      f. Stitches per inch: 10.8.
      g. Finished Pile Thickness: 0.089 inches.
      h. Average Density: 7685.
      i. Dye Method: Solution dyed.
      j. Secondary Backing: EcoFlex ICT.
      k. Warranty: Lifetime Commercial Limited.

B. **Colors** as noted on Finish Legend on Drawings or, if not noted, as selected by Architect from manufacturer's full range.

2.2 INSTALLATION ACCESSORIES

A. **Trowelable Leveling and Patching Compounds**: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. **Adhesives**: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. **Concrete Subfloors**: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. **Proceed with installation** only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **General**: Comply with CRI Standard and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. **Use trowelable leveling and patching compounds**, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. **Remove coatings**, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. **Broom and vacuum clean substrates** to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. **General**: Comply with CRI Standard and with carpet tile manufacturer's written installation instructions.

B. **Installation Method**: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. **Maintain dye lot integrity**. Do not mix dye lots in same area.

D. **Cut and fit carpet tile to butt tightly** to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. **Extend carpet tile into toe spaces**, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. **Maintain reference markers**, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. **Install pattern parallel** to walls and borders. Quarter turn accent colors or as indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. **Perform the following operations** immediately after installing carpet tile:
1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. **Protect installed carpet** tile in compliance with CRI Standard.

C. **Protect carpet tile** against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 09 9123

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. **Section includes** painting work, interior and exterior. Work includes, but is not limited to painting the following:
   1. Exterior concrete where indicated on Drawings.
   2. Metal doors, metal door frames, grilles, frames and fire extinguisher cabinet doors.
   3. Exterior metal mechanical units, grilles and louvers.
   4. Interior walls and ceilings.
   5. Miscellaneous metal.
   6. Interior wood including but not limited to trim, moldings and miscellaneous items.
   7. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, plug mold, electric panels, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

B. **Related Sections:**
   1. **Key-Finish** on Drawings for product selections and colors.
   2. **Shop Primers**: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
      a. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.
      b. Comply with PDCA Standard P15 “Painting of Shop Primed Substrates”

C. "**Paint**" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

D. **Gloss and Sheen Definitions** shall determine the equivalency of the desired finish luster when described in the construction documents by a traditional name instead of gloss units due to the wide variance of sheen descriptions available from manufacturer to manufacturer. Gloss shall be determined by ASTM D523 - 08 Standard Test Method for Specular Gloss.
   1. Flat: Refers to a lusterless or matte finish with a gloss range below 5 units when measured with a 60 degree meter and no more than 10 units measured at an 85 degree meter.
   2. Low-Sheen: Refers to a velvet-like finish with a gloss range below 10 units when measured with a 60 degree meter and between 10-35 units measured at an 85 degree meter.
   4. Satin: Refers to low-to-medium range finish with a gloss range between 20-35 units when measured with a 60 degree meter and at least 35 units measured at an 85 degree meter.

5. Semi-Gloss: Refers to a medium sheen finish with a gloss range between 35-70 units when measured with a 60 degree meter.
6. Gloss: Refers to a high sheen finish with a gloss range between 70-85 units when measured with a 60 degree meter.
7. High-Gloss: Refers to a very high sheen finish with a gloss range more than 85 units when measured with a 60 degree meter.

E. **Drywall Finishing Levels**: Except where otherwise specified, a Drywall Finishing Level 5 is required on gypsum board substrates scheduled to receive an eggshell or higher sheen. Drywall Finishing Level 4 is acceptable with the use of flat and low-sheen paints, except where critical lighting conditions are determined to be an issue by the Architect.

F. **Surfaces to be Painted**: Except where natural finish of material is specifically noted as a surface not to be painted, paint all exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from manufacturer's full range of colors and finishes. Multiple colors will be selected by the Architect for any type of paint system. If colors are not indicated on the drawings, provide for a minimum of 20 percent of the walls to be an accent color.
1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
2. Walls behind scheduled coverings shall receive prime coat.
3. If it can be seen, *paint it*.

G. **Following categories of work are not included** as part of field-applied finish work:
1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, pre-finished partition systems, architectural woodwork and casework, elevator entrance doors and frames, elevator equipment, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.
2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces and duct shafts.
3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
5. Labels: Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.3 SUBMITTALS

A. **Product Data**: Submit manufacturer's technical information including Paint label analysis and application instructions for each material proposed for use.

B. **Sustainability**: For paints and coatings, printed statement of VOC content demonstrating conformance to Utah Air Quality Regulations (R307-361).

C. **Samples**: Prior to beginning work, review Finish Schedule for colors to be painted. Use representative colors when preparing samples for review. Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.
   1. On 12 inch x 12 inch hardboard, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.
   2. On actual wood surfaces, provide two 4 inch x 8 inch samples of natural and stained wood finish. Label and identify each as to location and application.
   3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. Refer to “Mockups” below.

1.4 QUALITY ASSURANCE

A. **Single Source Responsibility**: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. **Coordination of Work**: Review other sections of these 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, to ensure compatible prime coats are used.

C. **Mockups**: Apply full-coat 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. Simulate finished lighting conditions for review of in-place work.
   1. Architect will select one surface, except as noted below, 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.
      c. Masonry to Receive Clear Coat: Provide free-standing samples of honed masonry, 48 inches x 48 inches for initial review of clear coat.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color/sheen selections are not approved, apply additional mockups of additional colors/sheens 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.

1.5 DELIVERY AND STORAGE

A. **Deliver materials** to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Name or title of material.
   2. Federal Specification number, if applicable.
   3. Manufacturer's batch number and date of manufacture.
   4. Manufacturer's name.
   5. Contents by volume, for major pigment and vehicle constituents.
   6. Thinning instructions.
   7. Application instructions.
   8. Color name and number.

B. **Store materials** not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
   1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.6 PROJECT CONDITIONS

A. **Apply water-based paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.

B. **Apply solvent-thinned paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.

C. **Do not paint in snow, rain, fog or mist,** or when relative humidity exceeds 85 percent, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
   1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. **Determine moisture content of surfaces** to be painted by performing appropriate tests using a commercially available moisture meter. Apply paint only when surfaces are within limits specified by the paint manufacturer’s printed instructions.

1.7 MAINTENANCE MATERIALS

A. **Furnish extra materials** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gallon (3.8 L) of each material and color applied.
   2. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. **Basis of Design Manufacturer**: Contract Documents are based on products specified in Part 3 Schedules to establish a standard of quality. Other acceptable manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
   1. Manufacturer: **Sherwin-Williams** Company.

B. **Acceptable Manufacturers**: Subject to compliance with requirements of Contract Documents, provide products by one of the following manufacturers.
   1. PPG Industries, Pittsburgh Paints.
   2. The Sherwin-Williams Company (S-W).
   3. Benjamin Moore & Co.

2.2 MATERIALS

A. **Low-Emitting Materials -** VOC Content (Utah Administrative Code R307-361): Products shall comply with VOC limits of authorities having jurisdiction and, for interior and exterior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 100 g/L.
   3. Dry-Fog Coatings: 150 g/L.
   4. Primers, Sealers, and Undercoaters: 100 g/L.
   5. Industrial maintenance Coatings Applied to Ferrous Metals: 250 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings Foot Traffic: 100 g/L.
   9. Floor Coatings High Performance: 250 g/L.
   10. Shellacs, Clear: 730 g/L.
   11. Shellacs, Pigmented: 550 g/L.
   12. Wood Coatings: 275 g/L

B. **Material Quality**: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

C. **Proprietary names** used to designate color or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

D. **Federal Specifications** establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.

E. **Manufacturer's products** which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Architect. Furnish material data and manufacturer's certificate of performance to Architect for any proposed substitutions.

F. **Color Pigments**: Pure, non-fading, applicable types to suit substrates and service indicated.

G. **Lead content in pigment**, if any, is limited to contain not more than 0.009 percent lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.
   1. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Applicator must examine areas** and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
   1. Comply with PDCA Standard P4 “Responsibility for Inspection and Acceptance of Surfaces prior to Painting and Decorating

B. **Starting of painting work** will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. **Do not paint over dirt**, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 PREPARATION

A. **General**: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. **Barrier Coats**: Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

C. **Accessories Removal**: Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

D. **Surface Preparation**: Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

E. **Cementitious Materials**: Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
   1. **Determine alkalinity and moisture content** of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
   2. Concrete Floors:
      a. Floors must be structurally sound and fully cured a minimum of 28 days. Test floor for vapor drive in accordance with ASTM D 4263, ASTM F 2170 or ASTM F 2420. If vapor drive exceeds the levels recommended by the manufacturer of the flooring system, a moisture mitigation system, as approved by Architect, may be applied to reduce the permeance of moisture vapor to acceptable levels.
      b. Repair concrete as necessary.
      c. Use a commercial degreaser to clean floors of oil, grease, and other bond inhibiting materials.

d. Remove curing and parting compounds and other surface hardeners and floor coatings in accordance with the manufacturer's instructions.
e. Mechanical surface profiling is the recommended method of surface preparation for both new and existing floors. Mechanically profile the floor to CSP 3 (approximately medium grit sandpaper) as described by the International Concrete Repair Institute (Guideline #310.2). Do not use acid etching for surface preparation. Do not use any method that will fracture the concrete.
f. Apply a 25 square foot (2.32 square meter) test in an inconspicuous area that meets Owner's expectation for appearance, slip resistance and performance.

F. **Ferrous Metals**: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
1. Caulk fabrication joints in hollow metal door frames which paint application cannot bridge.
2. Follow manufacturer's surface preparation recommendations for ferrous metal substrates, ranging from one of the following procedures:
a. SSPC-SP 1 - Solvent Cleaning (Nov-04)
b. SSPC-SP 2 - Hand Tool Cleaning (Nov-04)
c. SSPC-SP 3 - Power Tool Cleaning (Nov-04)
d. SSPC-SP 5/NACE No. 1 - White Metal Blast Cleaning (Jan-07)
e. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning (Jan-07)
f. SSPC-SP 7/NACE No. 4 - Brush-Off Blast Cleaning (Jan-07)
g. SSPC-SP 8 - Pickling (Nov-04)
h. SSPC-SP 10/NACE No. 2 - Near-White Metal Blast Cleaning (Jan-07)
i. SSPC-SP 11 - Power Tool Cleaning to Bare Metal (July-12)
j. SSPC-SP 14/NACE No. 8 - Industrial Blast Cleaning (Jan-07)
k. SSPC-SP 15 - Commercial Grade Power-Tool Cleaning (July-12)
l. SSPC-SP 16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals (Apr-10

G. **Touch-up**: Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.

H. **Galvanized Surfaces**: Clean free of oil and surface contaminants with non-petroleum based solvent. Comply with best practices specified in ASTM D6386 - 10 "Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting."

I. **Wood**: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, fry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
2. When transparent finish is required, use spar varnish for backpriming.

3. Exterior Wood Substrates:
   a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   b. Prime edges, ends, faces, undersides, and backsides of wood.
      1) For solid hide stained wood, stain edges and ends after priming.
      2) For varnish-coated stained wood, stain edges and ends and prime with varnish. Prime undersides and backsides with varnish.
   c. Countersink steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.
4. Interior Wood Substrates:
   a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   b. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
   c. Sand surfaces exposed to view and dust off.
   d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

J. **Materials Preparation**:
1. Mix and prepare painting materials in accordance with manufacturer's directions.
2. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
3. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.3 APPLICATION

A. **General**: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
2. Provide finish coats which are compatible with prime paints used.
3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
7. Finish doors on tops, bottoms and side edges same as faces, unless otherwise indicated.
8. Sand lightly between each succeeding enamel or varnish coat.
9. Omit first coat (exterior faces) of surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. **Scheduling Painting**: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. Re-coat Time: Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firms, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
   2. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

C. **Mechanical and Electrical Work**: Painting of mechanical and electrical work is limited to those items exposed to mechanical equipment rooms and in occupied spaces.
   1. Mechanical items to be painted include, but are not limited to, the following:
      a. Piping, pipe hangers, and supports.
      b. Roof mounted mechanical units.
      c. Ductwork, where exposed in occupied spaces.
      d. Motor, mechanical equipment, and supports.
      e. Accessory items.
   2. Electrical items to be painted include, but are not limited to, the following:
      a. Conduit and fittings.

D. **Prime Coats**: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
   1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. **Pigmented (Opaque) Finishes**: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

F. **Completed Work**: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

A. **Owner will engage services of an independent testing laboratory** to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
   1. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

B. **If test results show** that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.5 CLEAN-UP AND PROTECTION

A. **Clean-Up**: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
   1. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using car not to scratch or otherwise damage finished surfaces.

B. **Protection**: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
   1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
   2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

A. **General**: Provide the following paint systems for the various substrates as indicated below or equivalent system from acceptable manufacturers listed above.

B. **Metal** (Galvanized)

Sherwin-Williams - Latex (100% Acrylic) Systems
- 1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series
  Finish: Low sheen.
  Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.
  VOC: Less than 100 g/L
- 2nd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
- 3rd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
  Finish: Gloss
  Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

C. **Metal** (Misc. Iron, Ornamental Iron, Cat Walks, Fire Escapes, Hydrants, Handrails, Ladders, Fences, etc.)

Sherwin-Williams - Latex (100% Acrylic) Systems
- 1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series
  Finish: Low sheen.
  Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.
  VOC: Less than 100 g/L (LEED VOC limits do not apply on exterior)
- 2nd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
- 3rd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
  Finish: Gloss
  Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

D. **Concrete (Exterior Painted)**

Surface Preparation: Allow new cast-in-place concrete to cure minimum of 28 days at 75 degrees F. Verify concrete dryness and prepare concrete surfaces in accordance with SSPC-SP13 and ICRI Technical Guidelines. Abrasive blast or high pressure water blast concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide and ICRI-CSP 2-3 surface profile.

Tnemec - Acrylic
1st Coat: Tnemec Enviro-Crete Series 156.
Finish: Matte.
Thickness (Mils per coat): 6 - 8 dry.
2nd Coat: Tnemec Enduratone Series 1028
Finish: Gloss
Thickness (Mils per coat): 2 - 3 dry.
3rd Coat: Tnemec Enduratone Series 1028
Finish: Gloss
Thickness (Mils per coat): 2 - 3 dry.

3.7 INTERIOR PAINT SCHEDULE

A. **General**: Provide the following **paint systems** for the various substrates as indicated below **or equivalent system** from approved manufacturers listed above.

B. **Metal** - (Interior Galvanized)

Sherwin-Williams - Latex (100% Acrylic) Systems
1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series
Finish: Low sheen.
Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.
VOC: Less than 100 g/L
2nd Coat: S-W Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 Series
Finish: Semi-Gloss
Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

C. **Metal** - (Interior Structural Steel **-** Columns, Joists, Trusses, Beams - Misc. & Ornamental Iron, Doors, Door Frames, Non-Galvanized Metal)

Sherwin-Williams - Latex (100% Acrylic) Systems
1st Coat: S-W Pro Industrial Pro-Cry Universal Primer B66-310 Series
Finish: Low sheen.
Thickness: (Mils per coat) 5 - 10 wet; 2 - 4 dry.
VOC: Less than 100 g/L
2nd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
Finish: Gloss
Thickness: (Mils per coat) 6 - 12 wet; 2.5 - 4 dry.

D. **Gypsum Board** (Walls, Ceilings, Gypsum Board, Etc.)

Sherwin-Williams - Vinyl Acrylic Systems

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600 Series.
Finish: Flat
Sheen (at 85 degrees): 0 - 5 units.
Thickness: (Mils per coat) 4 wet; 1.5 dry.
VOC: 0 g/L

2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
Finish: Semi-Gloss
Sheen (at 60 degrees): 25 - 35 units
Thickness: (Mils per coat) 4 wet; 1.6 dry.
VOC: 0 g/L

Sherwin-Williams - Vinyl Acrylic Systems

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600 Series.
Finish: Flat
Sheen (at 85 degrees): 0 - 5 units.
Thickness: (Mils per coat) 4 wet; 1.5 dry.
VOC: 0 g/L

2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series

3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
Finish: Eggshell
Sheen (at 60 degrees): 5+ units
Thickness: (Mils per coat) 4 wet; 1.6 dry.
VOC: 0 g/L

E. **Gypsum Board** (Interior Epoxy System - Walls, Ceilings, Gypsum Board, Etc.)

Sherwin-Williams - Epoxy System (Water Base) with Vinyl Acrylic Primer

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W02600 Series.
Finish: Flat
Sheen (at 85 degrees): 0 - 5 units
Thickness (Mils per coat): 4 wet; 1.5 dry.
VOC: 0 g/L

2nd Coat: S-W Pro Industrial Zero VOC Water-Based Epoxy Gloss, B73-300 series

3rd Coat: S-W Pro Industrial Zero VOC Water-Based Epoxy Gloss, B73-300 series
Finish: Gloss (Verify with Architect and Owner)
Sheen (at 60 degrees): 90+ units.
Thickness (Mils per coat): 5 - 10 wet; 2 - 4 dry.
VOC: 0 g/L

F. **Gypsum Board** (Interior Graphics, Deep Tone Accents, Special Features, etc.)

Sherwin-Williams - Vinyl Acrylic
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 Series
Finish: Flat
Sheen (at 85 degrees): 0 - 5 units
Thickness: (Mils per coat) 4 wet; 1.5 dry.
VOC: 0 g/L
2nd Coat: S-W ProMar 200 Zero VOC Semi-Gloss B31-2600 series
3rd Coat: S-W ProMar 200 Zero VOC Semi-Gloss B31-2600 series
Sheen (at 60 degrees): 25 - 35 units.
Thickness (Mils per coat): 4 wet; 1.6 dry.
VOC: 0 g/L

G. **Gypsum Board** (Interior behind wall panels, casework, etc.)

Sherwin-Williams - Vinyl Acrylic
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Wall Primer, B28W2600 Series.
Finish: Flat
Sheen (at 85 degrees): 0 - 5 units
Thickness: (Mils per coat) 4 wet - 1.5 dry.
VOC: 0 g/L

H. **Woodwork** (Stained & Varnished - Clear Finish**)**

Open Grained Wood
1st Coat: S-W WoodClassics 250 g/L Stain, A49W800 Series
2nd Coat: S-W SHERWOOD Natural Filler, D70T1
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
4th Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
Closed Grain Wood
1st Coat: S-W WoodClassics 250g/L Stain, A49W800 Series
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

I. **Woodwork** (Natural - Clear Finish)

Open Grained Wood
1st Coat: S-W SHERWOOD Natural Filler, D70T1
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
3rd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
Closed Grain Wood
1st Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC
2nd Coat: S-W Minwax WB Polyurethane Satin, <275 g/L VOC

J. **Woodwork** (Painted)

Latex Systems - Semi-Gloss

1st Coat:	S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 Series.
2nd Coat:	S-W ProMar 200 Zero VOC Semi-Gloss B31-2600 series
3rd Coat:	S-W ProMar 200 Zero VOC Semi-Gloss B31-2600 series

Thickness (Mils per coat): 4 wet; 1.6 dry

END OF SECTION

DIVISION 10 - SPECIALTIES

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SECTION 10 1419

DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes**:
   1. Cutout dimensional characters.

1.3 ACTION SUBMITTALS

A. **Product Data**: For each type of product.

B. **Shop Drawings**: For signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.

C. **Samples for Verification**: For each type of sign assembly showing all components and with the required finish, in manufacturer's standard size.

D. **Product Schedule**: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 WARRANTY

A. **Special Warranty**: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. **Cutout Characters**: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles.
   1. Character Material: Sheet or plate aluminum.
   2. Character Height: 60 inches, but not less than as indicated on Drawings.
   3. Thickness: Manufacturer's standard for size of character.
   4. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
   5. Mounting: As indicated on Drawings.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. **Aluminum Sheet and Plate**: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. **Aluminum Extrusions**: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

A. **Fasteners and Anchors**: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish nonferrous-metal devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
      b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
   4. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

2.4 FABRICATION

A. **General:** Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

A. **Protect mechanical finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. **Appearance of Finished Work**: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. **Directional Finishes**: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

2.6 ALUMINUM FINISH

A. **Clear Anodic Finish**: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates, areas, and conditions**, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. **Verify that sign-support surfaces** are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. **General**: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. **Mounting Methods**:
   1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. **Remove and replace damaged or deformed characters** that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. **Remove temporary protective coverings** and strippable films as signs are installed.

C. **On completion of installation**, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 2243.13

CHAIN LINK PARTITIONS AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** the following:
   1. Galvanized-steel chain link fabric.
   2. Galvanized-steel framework.
   3. Swing and horizontal slide gates and gate hardware.

1.3 PERFORMANCE REQUIREMENTS

A. **Structural Performance:** Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 15 feet high, and post spacing not to exceed 10 feet for galvanized fence system.

1.4 SUBMITTALS

A. **Product Data**: Provide product data in the form of manufacturer's technical data, specifications, and installation instructions for fence posts, fabric, and accessories.

B. **Shop Drawings**: Provide shop drawings showing location of fence, each post, and details of post installation, and accessories. Show connections to overhead structural system.

C. **Delegated-Design Submittal**: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. **Delegated Design**: Engage a qualified professional engineer, licensed in the State of Utah, to design chain-link fence and gate frameworks.

B. **Structural Performance**: Chain-link fence and gate frameworks shall withstand the design loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
   1. Minimum Post Size: Determine according to ASTM F1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F1043, Schedule 40 steel pipe.

C. **Installer Qualifications**: Engage an experienced Installer who has at least three years' experience and has completed at least five chain link fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.

D. **Single-Source Responsibility**: Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

1.6 PROJECT CONDITIONS

A. **Field Measurements**: Verify layout information for fences and gates shown on the Drawings in relation to existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

A. **Verify with Owner** that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.
   1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
      a. Failures include, but are not limited to, the following:
         1) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      b. Warranty Period: Five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 FABRIC

A. **Selvage**: Knuckled on both selvages.

B. **Steel Chain-Link Fence Fabric**: Fabricated in one-piece widths for fencing 15 feet and less in height (custom fabricated, if necessary) to comply with Chain Link Fence Manufacturers Institute (CLFMI) "Product Manual" and with requirements indicated below:
   1. Mesh and Wire Size: 2-inch mesh, 0.148-inch diameter (9 gage).
   2. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. before weaving.

2.2 FRAMING

A. **Fence Height**: 15 feet but not less than indicated on Drawings. Fence system may be braced from overhead structural system.

B. **Type I Round Posts**: Standard weight (schedule 40) galvanized-steel pipe conforming to ASTM F 1083, according to heavy industrial requirements of ASTM F 669, Group IA, with minimum yield strength of 25,000 psi, not less than 1.8 oz. of zinc per sq. ft. Type A coating inside and outside according to ASTM F 1234, as determined by ASTM A 90, and weights per foot as follows:

Actual OD	Weight (lb/ft)	NPS Size
1.315	1.68	1
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2-1/2
3.500	7.58	3
4.000	9.11	3-1/2
6.625	8.97	6
8.625	28.55	8

B. **Top Rail**: Manufacturer's longest lengths (17 to 21 feet) with swedged-end or expansion-type coupling, approximately 6 inches long for joining. Provide rail ends or other means for attaching top rail securely to each gate corner, pull, and end post.
1. Round Steel: 1.660-inch OD Type I or II steel pipe.

C. **Steel posts for fabric heights over 6 feet**:
1. Round Line or Intermediate Posts: 2.375-inch OD Type I or II steel pipe, but not less than sizing required for height and spans, as determined by design engineer.
2. Round End, Corner, and Pull Posts: 2.875-inch OD Type I or II steel pipe, but not less than sizing required for height and spans, as determined by design engineer.

E. **Swing Gate Posts**: Furnish posts to support single gate leaf, or one leaf of a double-gate installation, according to ASTM F 900, sized as follows for steel pipe posts:
1. Framework Member Sizes and Strength: Based on gate fabric height as indicated.

2.3 FITTINGS AND ACCESSORIES

A. **Material**: Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel to suit manufacturer's standards.
1. **Steel and Iron**: Unless specified otherwise, hot-dip galvanize pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. zinc per sq. ft. as determined by ASTM A 90.

B. **Post and Line Caps**: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

C. **Post Brace Assembly**: Manufacturer's standard adjustable brace. Use material specified below for brace, and truss to line posts with 3/8-inch-diameter rod and adjustable tightener. Provide manufacturer's standard galvanized-steel cap for each end.
1. **Round Steel:** 1.660-inch OD Type I or II steel pipe but not less than sizing required for height and spans, as determined by design engineer.

D. **Tension or Stretcher Bars**: Hot-dip galvanized steel with a minimum length 2 inches less than the full height of fabric, a minimum cross section of 3/16 inch by 3/4 inch, and a minimum of 1.2 oz. of zinc coating per sq. ft. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into the post.

E. **Tension and Brace Bands**: 3/4-inch-wide minimum hot-dip galvanized steel with a minimum of 1.2 oz. of zinc coating per sq. ft.
1. Tension Bands: 0.074 inch thick (14 gage) minimum.
2. Brace Bands: 0.105 inch thick (12 gage) minimum.

F. **Metallic-Coated Steel Wire**: 0.177-inch- diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:
1. Type II: Zinc coated (galvanized) by hot-dip process, with not less than 1.2 oz./sq. ft. of uncoated wire

G. **Tie Wires**: 0.106-inch-diameter (12-gage) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating according to ASTM A 641, Class 3 or equal, to match fabric wire.

2.5 GATES

A. **General**: Fabricate perimeter frames of gates from same material and finish as fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8 feet apart unless otherwise indicated.
1. Fabric: Same as for fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with tie wires.
2. Bracing: Install diagonal cross-bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.

B. **Swing Gates**: Comply with ASTM F 900.
1. Pipe and Tubing:
   a. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
   b. Gate Posts: Round tubular steel.
   c. Gate Frames and Bracing: Round tubular steel.
2. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:
   a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening – verify swing with Architect. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
   b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
   c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.

C. **Horizontal Slide Gates**
1. General: ASTM F1184 for gate posts and single sliding gate types**.**
2. Classification: Type I Overhead Slide.
   a. Gate Leaf Width: As indicated but not less than 10 feet.
   b. Framework Member Sizes and Strength: Based on gate fabric height of more than 72 inches.

3. Pipe and Tubing:
   a. Zinc-Coated Steel: Protective coating and finish to match fence framework.
   b. Gate Posts: ASTM F1184. Provide round tubular steel.
4. Frame Corner Construction: Welded.
5. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
6. Hardware:
   a. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel
   b. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
   c. Lock: Coordinate with Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **General**: Install fence to comply with ASTM F 567.
   1. Apply fabric to outside of framework. Install fencing as shown on Drawings.
   2. Brace system from structure above.

B. **Posts Set into Concrete in Sleeves:** Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. **Setting Posts**: Space a maximum of 10 feet o.c., unless otherwise indicated.

D. **Top Rails**: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

E. **Brace Assemblies**: Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. **Bottom Tension Wire**: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11-gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c.

G. **Fabric**: Leave approximately 2 inches between finish floor and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains under tension after pulling force is released.

H. **Tension or Stretcher Bars**: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

I. **Tie Wires**: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.
   1. Maximum Spacing: Tie fabric to line posts, rails and braces at 12 inches o.c.

J. **Fasteners**: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.

3.2 GATE INSTALLATION

A. **Install gates according to manufacturer's written instructions**, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.3 ADJUSTING

A. **Gates**: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. **Lubricate hardware and other moving parts**.

3.4 DEMONSTRATION

A. **Engage a factory-authorized service representative** to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 10 2800

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This **Section includes** toilet and bath accessories.

1.3 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. **Samples**: For each accessory item to verify design, operation, and finish requirements.
1. Approved full-size Samples will be returned and may be used in the Work.

C. **Setting Drawings**: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

D. **Product Schedule**: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

E. **Maintenance Data**: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. **Source Limitations**: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. **Product Options**: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

A. **Coordinate accessory locations** with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. **Deliver inserts** and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. **General Warranty**: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. **Manufacturer's Mirror Warranty**: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
   1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. Underlavatory Guards:
      a. Brocar Products, Inc.
      b. Truebro, Inc.

2.2 MATERIALS

A. **Stainless Steel**: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. **Brass**: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. **Sheet Steel**: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. **Galvanized Steel Sheet**: ASTM A 653/A 653M, G60.

E. **Chromium Plating**: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. **Baked-Enamel Finish**: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. **Mirror Glass**: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. **Galvanized Steel Mounting Devices**: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. **Fasteners**: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. **General**: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. **Surface-Mounted Toilet Accessories**: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. **Recessed Toilet Accessories**: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. **Framed Glass-Mirror Units**: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. **Mirror-Unit Hangers**: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
   1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. **Keys**: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **Install accessories according to manufacturers' written instructions**, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. **Secure mirrors** to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. **Install grab bars** to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. **Adjust accessories** for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. **Remove temporary labels** and protective coatings.

C. **Clean and polish** exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. **Toilet Tissue Dispenser**:
1. Basis of Design Product: Bobrick, B-262
2. Surface-mounted multi-roll toilet tissue dispenser shall be type-304 stainless steel with all-welded construction, including dispensing mechanism, inner housing and cam; exposed surfaces shall have satin finish. Front of toilet tissue dispenser door shall be drawn, one-piece, seamless construction. Door shall be secured to cabinet with two rivets and equipped with a tumbler lock keyed like other washroom accessories. Unit shall dispense two standard-core toilet tissue rolls up to 5-1/4 inch diameter (1800 sheets). Extra roll shall automatically drop in place when bottom roll is depleted. Unit shall be equipped with two theft-resistant, heavy-duty, one-piece, molded ABS spindles.

B. **Towel Dispenser**: Owner-furnished/installed; verify blocking and other requirements.

C. **Surface Mounted Soap Dispenser**: Owner-furnished/ installed; verify blocking and other requirements.

D. **Grab Bar**:
1. Basis of Design Product: Bobrick, B-6806 Series
2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
3. Lengths: As indicated on Drawings and as required for barrier free compliance.
4. Mounting: Concealed with manufacturer's standard flanges and anchors.
5. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
6. Outside Diameter: 1-1/2 inches for heavy-duty applications.

E. **Mirror Unit:**

1. Basis of Design Product: Bobrick, B-290 Series.
2. Frame mirror with one-piece, type-304, stainless steel angle 3/4 x 3/4 inch; roll-formed construction with continuous integral stiffener on all sides. Frame shall have beveled design on front of angle to hold mirror tightly against frame to prevent exposure to sharp edges. Corners shall be heliarc welded, ground, and polished smooth. Exposed surfaces shall have satin finish with vertical grain. Mirror shall be No. 1 quality, 1/4 inch (6mm) float/plate glass. Protect mirror edges with plastic filler strips; protect mirror back by full-size, shock-absorbing, water-resistant, non-abrasive 3/16 inch thick polyethylene padding. Galvanized steel back shall have integral horizontal hanging brackets located at top and bottom for mounting on concealed one-piece rectangular wall hanger(s). Fasten galvanized steel back to frame with concealed screws to permit glass replacement; attachment by rivets or tabs is not acceptable. Secure mirror to hanger with concealed Phillips head locking setscrews in bottom of frame.
3. Size: 24 x 36 inches, 96 x 36 inches and as shown on Drawings.

F. **Mop and Broom Holder:**

1. Basis of Design Product: Bobrick, B-224x48.
2. Mop and Broom Holder with Utility Shelf: 48-inch- long unit fabricated of minimum nominal 0.05-inch- thick stainless steel with shelf; support brackets for wall mounting; three hooks for wiping rags; four spring-loaded, rubber hat, cam-type, mop/broom holders mounted on front of shelf; and approximately 1/4-inch- diameter, stainless-steel rod suspended beneath shelf for drying rags.

G. **Under-Lavatory Guard:** Provide under-lavatory guard where lavatory piping is exposed below the counter or with wall hung lavatories. Under-lavatory guards to complying with the following

1. Basis of Design Product: Truebro, Inc.
2. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

END OF SECTION

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SECTION 10 4400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes:**
   1. Multipurpose dry chemical portable fire extinguishers:
   2. Fire-protection cabinets for portable fire extinguishers:
   3. Fire-protection accessories.

1.3 SUBMITTALS

A. **Product Data**: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. **Samples for Selection**: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

1.4 QUALITY ASSURANCE

A. **Source Limitations**: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. **NFPA Compliance**: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. **Fire Extinguishers**: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. **Coordinate size of cabinets** to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design (Cabinets)**: Contract Documents are based on products listed below to establish a standard of quality. Other available manufacturers offering products with equivalent characteristics may be considered, provided deviations are minor and design concept as expressed in the Contract Documents is not changed, as judged by the Architect.
   1. Manufacturer: J.L Industries, part of the Activar Construction Products Group, Inc.
   2. Product: Ambassador**,** 1017W10 - 1 1/2 inch Semi-Recessed cabinet with painted steel rolled trim with a contemporary vertical clear acrylic window

B. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Portable Fire Extinguishers:
      a. Owner’s standard supplier; verify fit in cabinets.
   2. Fire-Protection Cabinets:
      a. J.L. Industries, Inc., a division of Activar Construction Products Group.
      b. Larsen's Manufacturing Company; A member of Morris Group International.
      c. Potter-Roemer**;** A member of Morris Group International.

2.2 MATERIALS

A. **Cold-Rolled Steel Sheet**: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.3 PORTABLE FIRE EXTINGUISHERS

A. **General**: Provide fire extinguishers as indicated in the Summary above.

B. **Multipurpose Dry-Chemical Type**: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled-steel container.

C. **Wet-Chemical Type**: UL-rated **2**-A:1-B:C:K, 1.6-gallon nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gage.

2.4 FIRE-PROTECTION CABINETS

A. **Cabinet Construction**: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
   1. Cabinet Metal: Enameled steel sheet.

B. **Cabinet Type**: Suitable for fire extinguisher.

C. **Cabinet Mounting**: Suitable for the following mounting conditions:
   1. Recessed or Semi-Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   2. Surface Mounted**:** Cabinet box fully exposed and mounted directly on wall.

D. **Cabinet Trim Style**: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
   1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend)

E. **Cabinet Trim Material**: Manufacturer's standard, as follows:
   1. Steel sheet.

F. **Door Material**: Manufacturer's standard, as follows:
   1. Steel sheet.

G. **Door Glazing**: Smooth acrylic.
   1. Thickness: 6 mm.

H. **Door Style**: Manufacturer's standard design, as follows:
   1. Vertical acrylic panel with frame.

I. **Door Construction**: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
   1. Provide minimum 1/2-inch- thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

J. **Door Hardware**: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide door pull and replaceable break-away plastic cam latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 ACCESSORIES

A. **Mounting Brackets**: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
   1. Provide brackets for extinguishers not located in cabinets.
   2. Provide brackets for extinguishers located in cabinets.

B. **Door Locks**: Provide cylinder lock, with all cabinets keyed alike.

C. **Identification**: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
   2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
      a. Application Process: Silk-screened.
      b. Lettering Color: Red.
      c. Orientation: Vertical.

2.6 COLORS AND TEXTURES

A. **Colors and Textures**: As selected by Architect from manufacturer's full range for these characteristics.

2.7 FINISHES, GENERAL

A. **Comply with NAAMM's** "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. **Protect mechanical finishes** on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. **Appearance of Finished Work**: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. **Cabinet and Door Finishes**: Provide manufacturer's standard baked-enamel paint for the following:
   1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
   2. Interior of cabinets and doors.

2.8 STEEL FINISHES

A. **Surface Preparation**: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. **Epoxy primer**: Immediately after cleaning and pre-treating, apply manufacturer's standard white epoxy primer coated finish.
   1. Color: Painted to match wall see Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine walls** and partitions for suitable framing depth and blocking where fully-recessed cabinets are to be installed.

B. **Examine fire extinguishers** for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

C. **Proceed** with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. **Comply** with manufacturer's written instructions for installing fire-protection specialties.

B. **Install in locations** and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
   2. Fasten mounting brackets to structure and cabinets, square and plumb.
   3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. **Adjust** cabinet doors that do not swing or operate freely.

B. **Refinish or replace** cabinets and doors damaged during installation.

C. **Provide final protection** and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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DIVISION 11 - EQUIPMENT

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SECTION 11 1313

DOCK BUMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes** dock bumpers.

B. **Related Sections**:
1. Section 05 5000 "**Metal Fabrications**" for curb angles at edge of loading dock and for platform edge channels.
2. Section 11 1319 "**Stationary Loading Dock Equipment**" for dock levelers.

1.3 SUBMITTALS

A. **Product Data:** Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. **Shop Drawings:** Show details of fabrication and installation. Include plans, elevations, sections, details, and attachments to other work.
1. Provide templates for anchors and bolts anchored to permanent construction.

C. **Maintenance Data:** For loading dock equipment to include in the maintenance manuals specified in Division 1. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.4 QUALITY ASSURANCE

A. **Source Limitations:** Obtain each loading dock equipment component, including dock bumpers, levelers, lifts, and seals, as a complete unit from one source and by a single manufacturer.

1.5 COORDINATION

A. **Coordinate deliver**y of built-in anchoring devices to Project site to avoid delaying progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Available Manufacturers:** Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Durable Corporation.
   2. R.C. Musson Rubber Co.
   3. Rite-Hite Corporation.
   4. Serco.

2.2 DOCK BUMPERS

A. **Laminated-Tread Bumpers**: Provide units of size indicated, fabricated from multiple plies cut from fabric-reinforced rubber tires to a uniform thickness of 4-1/2 inches. Laminate plies under pressure on 3/4-inch- diameter, steel supporting rods that are welded and bolted to 1/4-inch- thick, structural-steel angle closures with predrilled anchor holes. Size angles to provide not less than 1 inch of tread plies extending beyond the face of closure angles.
   1. Length: As indicated on Drawings or if not indicated a minimum of 10' - 0".

B. **Anchorage Devices**: Provide anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plate, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanize anchorage components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine areas and conditions**, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.

B. **Proceed with installation** of loading dock equipment only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **General:** Coordinate installation of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

3.3 INSTALLATION, GENERAL

A. **General:** Comply with manufacturer's detailed written instructions for installing loading dock equipment.

3.4 DOCK-BUMPER INSTALLATION

A. **Attach dock bumpers** to structure in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. **Bolted Attachment:** Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.5 CLEANING AND PROTECTING

A. **Restore** marred, abraded surfaces to their original condition.

B. **Provide final protection** and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensure loading dock equipment is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 11 1319

STATIONARY LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. **Section Includes**:
   1. Recessed dock levelers.

B. **Related Requirements**:
   1. Section 05 5000 "**Metal Fabrications**" for curb angles at edges of recessed pits and loading dock platform edge channels.
   2. Section 11 1313 "**Loading Dock Bumpers"** for loading dock bumpers.

1.3 PREINSTALLATION MEETINGS

A. **Preinstallation Conference**: Conduct conference at Project site.
   1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
   2. Review sequence of operation for each type of loading dock equipment.
   3. Review coordination of interlocked equipment specified in this Section and elsewhere.
   4. Review required testing, inspecting, and certifying procedures.

1.4 DEFINITIONS

A. **Operating Range**: Maximum amount of travel above and below the loading dock level.

B. **Working Range**: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

1.5 ACTION SUBMITTALS

A. **Product Data**: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for stationary loading dock equipment.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. **Shop Drawings**: For stationary loading dock equipment.
   1. Include plans, elevations, sections, details, and attachments to other work.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of anchors and field connection.

1.6 INFORMATIONAL SUBMITTALS

A. **Qualification Data**: For Installer.

B. **Welding certificates**.

C. **Product Test Reports**: For each dock leveler, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Indicate compliance of dock levelers with requirements in MH 30.1 for determining rated capacity, which is based on comprehensive testing within last two years of current products.
2. Submittal Form: According to MH 30.1.

D. **Sample Warranty**: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. **Operation and Maintenance Data**: For stationary loading dock equipment to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. **Installer Qualifications**: An authorized representative who is trained and approved by manufacturer.
1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. **Welding Qualifications**: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.9 FIELD CONDITIONS

A. **Field Measurements**: Verify actual dimensions of construction contiguous with stationary loading dock equipment, including recessed pit dimensions, slopes of driveways and heights of loading docks, by field measurements before fabrication.

1.10 WARRANTY

A. **Manufacturer's Special Warranty**: Manufacturer agrees to repair or replace dock levelers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
      b. Faulty operation of operators, control system, or hardware.
      c. Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.
      d. Hydraulic system failures including failure of hydraulic seals and cylinders.
   2. Warranty Period for Structural Assembly: 10 years from date of Substantial Completion.
   3. Warranty Period for Hydraulic System: Five years from date of Substantial Completion.
   4. Warranty shall be for unlimited usage of leveler for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCTS

2.1 RECESSED DOCK LEVELERS

A. **General**: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.

B. **Available Manufacturers**: Subject to compliance with requirements of Contract Documents, manufacturers with products which may be incorporated into the Work include, but are not limited to, the following:
   1. Blue Giant USA Corporation; www.bluegiant.com
   2. DLM, Inc.; www.dlminc.net.
   3. Kelley Dock Systems, 4Fronted Engineered Solutions, Inc.; www.kelley.4frontes.com
   4. Rite-Hite Corporation; www.ritehite.com.
   5. Serco, 4Fronted Engineered Solutions, Inc.; www.serco.4frontes.com

C. **Standard**: Comply with MH 30.1, except for structural testing to establish rated capacity.

D. **Rated Capacity**: Capable of supporting total gross load of 20,000 lb without permanent deflection or distortion.

E. **Platform**: Not less than 1/4-inch- thick, nonskid steel plate.
   1. Platform Size: As indicated on Drawings.
   2. Frame: Manufacturer's standard.
   3. Toe Guards: Equip open sides of dock leveler over range indicated with metal toe guards.
      a. Toe-Guard Range: Entire upper operating range.

F. **Hinged Lip**: Not less than 1/2-inch- thick, nonskid steel plate.

1. Hinge: Full-width, piano-type hinge with heavy-wall hinge tube and grease fittings, with gussets on lip and ramp for support.
2. Safety Barrier Lip: Designed to protect material-handling equipment from an accidental fall from loading platform edge of the dock leveler when the leveler is not in use.

G. **Function**: Dock levelers shall compensate for differences in height between truck bed and loading platform.
1. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
   a. Above Adjoining Platform: 12 inches.
   b. Below Adjoining Platform: 12 inches.
2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
3. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 4 inches over width of ramp.
4. Lip Operation: Manufacturer's standard mechanism, which automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck and automatically retracts lip when truck departs.
   a. Length of Lip Extension: 16 inches.
5. Interlock: Leveler does not operate while overhead door is in closed position.

H. **Mechanical Operating System**: Manual control; counterbalance and spring operation. Spring-operated raising and walk-down lowering of unloaded ramp. Equip leveler with an upward-biased-spring counterbalancing mechanism controlled by a hold-down device. Ramp raises to top limit of operating range by operating recessed control handle in ramp to disengage hold-down device. Ramp lowers below platform level with lip retracted by operating auxiliary, recessed control handle to release support legs.
1. Free-Fall Protection: Manufacturer's standard protection system to limit free fall of loaded ramps with front edge supported by truck bed.

I. **Construction**: Fabricate dock-leveler frame, platform supports, and lip supports from structural- or formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.
1. Cross-Traffic Support: Manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
2. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.

J. **Materials**:
1. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.
2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380).
3. Steel Tubing: ASTM A 500/A 500M, cold formed.
4. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

K. **Dock-Leveler Finish**: Manufacturer's standard finish.
1. Toe Guards: Paint toe guards to comply with ANSI Z535.1.

L. **Accessories**:
1. Curb Angles: 3-by-3-by-1/4-inch galvanized-steel curb angles for edge of recessed leveler pit, with 1/2-inch- diameter by 6-inch- long concrete anchors welded to angle at 6 inches o.c.
2. Self-Forming Pan: Manufacturer's standard prefabricated, self-forming steel form system for poured-in-place construction of concrete pit.
3. Night Locks: Manufacturer's standard means to prevent extending lip and lowering ramp when overhead doors are locked.
4. Side and rear weatherseals.
5. Foam insulation under dock-leveler platform.
6. Abrasive skid-resistant or smooth surface, as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine areas and conditions**, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. **Examine roughing-in** for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.

C. **Examine walls and floors** of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.

D. **Proceed with installation only after** unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. **Coordinate size and location** of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

B. **Set curb angles in concrete edges** of dock-leveler recessed pits with tops flush with loading platform. Fit exposed connections together to form hairline joints.

C. **Place self-forming pan system** for recessed dock levelers in proper relation to loading platform before pouring concrete.

D. **Clean recessed pits** of debris.

3.3 INSTALLATION

A. **General**: Install loading dock equipment as required for a complete installation.
1. Rough-in electrical connections.

B. **Recessed Dock Levelers**: Attach dock levelers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.

3.4 ADJUSTING

A. **Adjust loading dock equipment** to function smoothly and safely, and lubricate as recommended by manufacturer.

B. **Test dock levelers** for vertical travel within operating range indicated.

C. **After completing installation** of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

3.5 MAINTENANCE SERVICE

A. **Maintenance Service**: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of loading dock equipment Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper loading dock equipment operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

A. **Engage a factory-authorized service representative** to train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

END OF SECTION

DIVISION 12 - FURNISHINGS

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SECTION 12 2400

ROLLER SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **This Section includes**:
1. Manually operated roller shades.

B. **Related Sections** include the following:
1. Section 06 1000 "**Rough Carpentry**" for wood blocking and grounds for mounting roller shades and accessories.

1.3 SUBMITTALS

A. **Product Data**: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
1. Motorized Shade Operators: Include operating instructions.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. **Shop Drawings**: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. **Samples for Verification**:
1. For the following products:
a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.
b. Color Selection: Include similar Samples of accessories involving color selection.

D. **Product Certificates**: For each type of roller shade product, signed by product manufacturer.

E. **Product Test Reports**: For each type of roller shade product.

F. **Qualification Data**: For Installer.

G. **Maintenance Data**: For roller shades to include in maintenance manuals. Include the following:
   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.
   4. Motorized shade operators.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications**: An experienced installer who has completed installation of roller shades similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. **Source Limitations**: Obtain roller shades through one source from a single manufacturer.

C. **Fire-Test-Response Characteristics**: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: Passes NFPA 701.

D. **Corded Window Covering Product Standard**: Provide roller shades complying with WCMA A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. **Deliver shades** in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. **Environmental Limitations**: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. **Field Measurements**: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. **Acceptable Manufacturers**: Subject to compliance with requirements of Contract Documents, provide products by one of the following:
   1. Draper, Inc.
   2. Levolor Commercial.
   3. MechoShade Systems, LLC.
   4. Hunter Douglas Architectural.

2.2 ROLLER SHADES

A. **Shade Band Material**: PVC-coated polyester.
   1. Material Width: Not less than 96 inches.
   2. Bottom Hem: Straight.
   3. Trim: As indicated by manufacturer's designation for style and color.
   4. Material Openness Factor: Not more than 3 percent, except blackout shall be completely opaque.
   5. Material Color: As selected by Architect from manufacturer's full range.

B. **Rollers**: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Drawings.

C. **Direction of Roll**: Regular, from back of roller.

D. **Mounting Brackets**: Galvanized or zinc-plated steel.

E. **Fascia**: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.

F. **Top/Back Cover**: L shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

G. **Bottom Bar**: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

H. **Shade Operation**: **Manual**; with continuous loop bead chain, clutch, and cord tensioner and bracket lift operator.
   1. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
   2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
   3. Loop Length: Length required to make operation convenient from floor level.
   4. Bead Chain: Nickel-plated metal.
   5. Cord Tensioner Mounting: Sill.
   6. Operating Function: Stop and hold shade at any position in ascending or descending travel.

I. **Mounting**: Bottom-up brackets mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

2.3 ROLLER SHADE FABRICATION

A. **Product Description**: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. **Concealed Components**: Non-corrodible or corrosion-resistant-coated materials.
   1. Lifting Mechanism: With permanently lubricated moving parts.

C. **Unit Sizes**: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 degrees F:
   1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
   2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. **Installation Brackets**: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. **Installation Fasteners**: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. **Color-Coated Finish**: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. **Colors of Metal and Plastic Components Exposed to View**: As selected by Architect from manufacturer's full range, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. **Examine substrates**, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. **Install roller shades level**, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. **Adjust and balance roller shades** to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. **Clean roller shade surfaces** after installation, according to manufacturer's written instructions.

B. **Provide final protection and maintain conditions**, in a manner acceptable to manufacturer and Installer, which ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. **Replace damaged roller shades** that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. **Engage a factory-authorized service representative** to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

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SECTION 12 3200

MANUFACTURED CABINETS AND CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. **Section includes** custom milled plastic laminate casework, shelving, brackets, supports, hardware, and accessory items.
   1. Work includes countertops.

B. **Related Sections**:
   1. Section 05 5000 "**Metal Fabrications**" for brackets supporting vanities and countertops.
   2. Section 06 2000 "**Finish Carpentry**" for solid surface window sills and wall caps.

C. **Work not included**:
   1. Plumbing, electrical, heating and ventilation service connections.
   2. Rubber or vinyl finish base.
   3. Blocking in walls as required for proper installation.

1.3 SUBMITTALS

A. **Product Data**: Submit manufacturer's product data for each product and process specified as work of this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

B. **Quality Certification**: Submit woodwork Manufacturer's (Fabricator's) certification, stating that fabricated woodwork complies with quality grades and other requirements indicated.

C. **Shop Drawings**: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Reuse of Architect's drawings not permitted.

D. **Samples**: Submit the following samples:
   1. Plastic laminate, 8 inch x 10 inch for each type, color, pattern and surface finish.
   2. Solid surface, 3 inch x 6 inch for each type, color, pattern, and surface finish.

1.4 QUALITY ASSURANCE

A. **AWMAC/WI Quality Standard**: Comply with applicable requirements of North American Architectural Woodwork Standards (NAAWS), except as otherwise indicated.
   1. Millwork and installation shall be in accordance with Custom or Premium Grade of the NAAWS, as indicated herein or on the Drawings. If provisions of the Grade specified are in conflict with, or modified by the Drawings or Specifications, the higher quality, better grade or greater quantity shall govern. Notify Architect of any conflicts prior to proceeding with fabrication.

2. Millwork contractor and installer shall include in their bid any and all costs for certified compliance. Under no circumstance shall the Owner incur additional expense due to the failure of the millwork to comply with NAAWS standards or to pass any inspection. Issuance of a Certified Compliance Certificate is a pre-requisite for final acceptance and final payment.

B. **Installer Qualifications**: Arrange for installation of architectural woodwork by a firm which can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

C. **Measurements:** Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.

D. **Casework Integrity:** Cabinets shall satisfy the NAAWS Appendix A testing standards.

E. **Testing**

1. **Owner reserves the right** to take random sampling of casework components to verify that the materials and construction are as specified. In the event that a sampling proves to be inferior to that which is specified, it will be assumed the entire installation does not conform to the Standard. Supplier shall, at his own expense, replace non-conforming components to the satisfaction of the Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. **Protect woodwork during transit**, delivery, storage and handling to prevent damage, soiling and deterioration.

B. **Do not deliver woodwork**, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 PROJECT CONDITIONS

A. **Conditioning**: Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. **Maintain temperature and humidity** in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Woodwork Manufacturer to establish optimum moisture content and required temperature and humidity condition.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. **Acceptable Mills**: Subject to compliance with requirements of Contract Documents, provide casework by one of the mills listed below. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections. Additionally, mills seeking qualification shall provide list of comparable projects in size and scope with education clients.
   1. Artistic Mill.
   2. Huetter Mill and Cabinet Company.
   3. Granite Mill and Fixture Company.
   4. Swainston Mill.
   5. Johnson Brothers.

B. **Acceptable Laminate Manufacturers:** Subject to compliance with requirements of Contract Documents, provide plastic laminate by one of the manufacturers listed below. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections.
   1. Formica Corp.
   2. Pionite
   3. WilsonArt.

C. **Acceptable Solid Surface/Quartz Surface Manufacturers**: Subject to compliance with requirements of Contract Documents, provide solid surface materials by one of the manufacturers listed below. If not listed, submit as a substitution according to the Conditions of the Contract and provisions of Division 1 sections.
   1. Radianz, Staron Solid Surfaces; Lotte Chemicals.
   2. Corian, DuPont.

2.2 MANUFACTURED UNITS

A. **Cabinets**:
   1. Quality Standard: Comply with AWS Section 10, Custom grade, flush overlay design.
   2. Vertical Surface High Pressure Plastic Laminate:
      a. High pressure plastic laminate for exterior surfaces shall be NEMA vertical grade 0.028 inch thickness, satin finish. Colors are to be selected from manufacturer's full color selection, including polished mirror types. Cabinet fronts for each individual cabinet shall be one color only.
      b. Balancing sheet on inside of doors, drawer fronts and finished ends shall be high pressure plastic laminate cabinet liner matching cabinet interior.
   3. Horizontal Surface High Pressure Plastic Laminate: High pressure plastic laminate for countertops and other horizontal surfaces shall be post-forming grade 0.039 inch thickness, satin finish. Colors to be selected from manufacturer's full color selection.
   4. Thermo-Fused Melamine to Particle Board:
      a. Melamine thermo-fused to a 45 pound density or better particle board substrate. Color shall be white.
      b. White colored melamine shall be standard for all cabinet interiors whether exposed or semi-exposed.

B. **Laminate Grade for Exposed Surfaces**: Provide laminate cladding complying with the following requirements for type of surface and grade.
   1. Horizontal Surfaces Other Than Tops: GP-50 (0.050 inch nominal thickness).
   2. Postformed Surfaces: PF-42 (0.039 inch nominal thickness).

C. **Edge-banding**:
   1. Edge-banding for cabinet body parts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Color shall be as selected by Architect from manufacturers full color range.
   2. Edge-banding for door and drawer fronts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with a 3mm radius and scraped free from machining or chatter marks. Color shall be as selected by Architect from manufacturers full color range.

2.3 MISCELLANEOUS MATERIALS

A. **Screws**: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
   1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. **Nails**: Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. **Anchors**: Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

D. **Finish Hardware**:
   1. Wall Shelf Standards: KV 82; heavy-duty, double-tracked, double-formed, 2 inch based standards. Epoxy powder finish.
   2. Wall Shelf Brackets: KV 182; 1 inch wide x 5/8 inch deep double slotted brackets adjustable on 1-3/4 inch centers.

2.4 FABRICATION

A. **General**:
   1. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.
   2. Dimensions and profiles: Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.
   3. Edges: Ease edges to a 1/16 inch radius, for corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness, 1/8 inch radius for edges of rails and similar members over 1 inch" in nominal thickness.
   4. Pre-assembly: Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

5. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

2.5 COMPONENT CONSTRUCTION

A. **Core Material**:
1. Core Material: Premium grade particleboard of balanced construction with a density of 45 lbs. per cubic foot and moisture content of 8 percent or less. Face screw holding shall be a minimum of 320 lbs. withdrawal.

B. **Adjustable Shelves**:
1. Adjustable shelves shall be 3/4 inch thick with melamine thermo-fused to core material on both sides for shelves up to 30 inch in width, and 1 inch thick for shelves over 30 inch in width.
2. Library bookshelves shall be 1 inch thick.
3. All exposed edges shall be banded with 3 mm thick PVC.

2.6 PLASTIC LAMINATE COUNTERTOPS

A. **Quality Standard:** Comply with NAAWS requirements for countertops.
1. Grade: Premium

B. **Post formed** with fully radiused edge (full bullnose), 1/32 inch high pressure plastic laminate over a 45 pound density, or better, particle board substrate. Bullnose edge shall project 1-1/2 inches beyond face of cabinet.
1. Wrap laminate the full radius of edge and return beyond the cabinet face. NO gap between edge of wrapped laminate and face of cabinet.

C. **Provide** 4 inch high coved integral backsplash and endsplash at all countertops.

D. **Seal penetrations** with silicone.

2.7 SOLID SURFACE AND QUARTZ-SURFACING-MATERIAL COUNTERTOPS

A. **Quartz:** Homogeneous mixture containing 93 percent pure quartz with additions of high performance polyester resin, pigments and special effects.

B. **Solid Surface Material**: Homogenous sheet composed of a blend of natural minerals and 100 percent acrylic resin (methyl methacrylate) complying with ANSI Z124.3 and Z124.6, Type 6.

C. **Quality Standard**: Comply with NAAWS requirements for countertops.
1. Grade: Premium.

D. **Thickness**: 3/4 inch.

E. **Adhesives**: As recommended by quartz surfacing manufacturer for specific application.

F. **Fittings**: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 PREPARATION

A. **Condition woodwork** to average prevailing humidity conditions in installation areas prior to installing.

B. **Prior to installation** of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

C. **Examine substrates** and brackets to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

3.2 INSTALLATION

A. **Install woodwork plumb, level, true and straight** with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

B. **Scribe and cut** work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

C. **Anchor woodwork** to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposing nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

D. **Provide seismic bracing** when required in accordance with the International Building Code, latest edition.

E. **Secure countertops to subtops** with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

F. **Install backsplashes and end splashes** by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. **Install aprons** to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. **Complete cutouts not finished in shop**. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. **Apply sealant** to gaps at walls; comply with Section 07 9200 "Joint Sealants."

3.3 CLEANING AND ADJUSTING

A. **Repair damaged and defective woodwork** where possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.

B. **Clean, lubricate** and **adjust** hardware.

C. **Clean woodwork** on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. **Provide final protection** and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

END OF SECTION

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DIVISIONS 13 – 20

Not Used

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CONSTRUCTION DOCUMENTS

general construction volume

2

divisions 21 thru 48

Warehouse 649 Remodel

180 GARNET STREET I TOOELE, UTAH

OWNER

Tooele County School District
92 Lodestone Way I Tooele, Utah 84074

DATE

16 August 2021

VCBO ARCHITECTURE

PROJECT MANUAL

524 South 600 East | Salt Lake City, UT 84102 | 801.575.8800 t | 801.531.9850 f | vcbo.com

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TABLE OF CONTENTS

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DIVISION 21 – FIRE SUPPRESSION

Section 21 1000 Water-Based Fire Suppression Systems

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SECTION 21 0000

FIRE PROTECTION

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of Section 220000, 230100, 230593, 230800, 230900, 233000 and 251000 shall govern the work in Section 210000, where applicable, and not in conflict with governing codes and ordinances. Division 1 is a part of this and all other sections of these specifications.

1.2 SCOPE

A. Work in this section is to include demolition of the existing dry fire system in its entirety.

B. Demolition is to include, but not limited to the following:

1. Existing risers from existing flange at slab.
2. Existing riser systems, all associated items, alarms and controls.
3. Existing system compressors.
4. Existing piping, fire heads, hangers, supports and bracing complete.

C. The work required includes the designing, hydraulically calculating pipe sizes, flows, and pressure, furnishing and installation of fire protection systems in accordance with the drawings, specifications, latest standards and codes for complete systems for the building.

D. The work specified in this section shall be installed by none other than an approved fire sprinkler contractor. All fire protection system piping shall be hydraulically calculated. All systems shall be subject to the inspection and approval of the local fire authority or his representative for compliance of applicable standards.

E. **Preferred contractors shall be Kimco Fire Protection, Chaparral Fire Protection, Fire Engineering Co., Paradise Fire Protection Inc. Delta Fire Protection Systems, Fire Services Inc., State Fire DC, Preferred Fire Protection and Firetrol Protection Systems.**

F. All work shall be coordinated with other subcontractors.

G. The sprinkler system shall consist of the required number of sprinkler heads, piping, hangers, drains, test pipes, alarms, valves, gauges, fire department connections, anti-freeze loop, and all other parts to assure a complete system to meet the requirements of the owner's insurance underwriter, local authority having jurisdiction, and in accordance with nationally recognized standards.

H. Codes & Standards:

1. Water Supply: National Fire Code #24 - 2018 International Building Code.
2. Wet Sprinkler System & Combined Systems: N.F.C. #13 and #14 - I.B.C.
3. Alarm Equipment: N.F.C. #70 & 72A
4. Standpipe & Hose Systems: N.F.C. #14 - I.B.C.
5. Supervision: N.F.C. #13 and #14 - I.B.C.
6. Temporary Fire Protection: N.F.C. #14 - I.B.C.
7. Sprinkler Heads: N.F.C. #13
8. Sleeves and Location: N.F.C. #13
9. Excavation and Backfill: 230900 of this specification

I. Work Included Elsewhere:

1. Fire Hydrants - By Site Utilities Contractor
2. Underground Mains: N.F.C. #24
3. Concrete Work - By General Contractor
4. Access Doors - By General Contractor.
5. Painting of sprinkler piping - By Painting Contractor.
6. Color coding or pipe identification - By Mechanical Contractor.
7. Wiring of flow switches and gate valve supervisory switches - By Electrical Contractor.

1.3 WORK BY FIRE PROTECTION CONTRACTOR

A. This contractor shall furnish and install all labor, material, and equipment to make a complete and working fire protection system fully tested and approved in accordance with the drawings, standards of this specification for the new building.

1.4 UNDERGROUND WATER SUPPLY

A. Fire protection contractor shall perform a flow test at or near site prior to final calculations for system. Flow test to be performed in the presence of local fire marshal and Tooele County School District representative.

B. Connect fire sprinkler mains to connections provided by others as shown on the drawings and install U.L. labeled pipes into building at locations shown. Coordinate testing and flushing of this portion of the main in accordance with N.F.C. #24 and furnish test certificates to the Owner's representative.

C. This contractor will be responsible to coordinate with the site utilities contractor to assure that the underground water supply has been flushed and tested in accordance with NFPA pamphlet #24 prior to the connection of the overhead sprinkler system.

D. Flow Test Information:

Date:	01-14-2020
Location:	Old Army Depot Building 649. 180 Gamet Street Tooele, Utah
Static Pressure:	50 PSI
Residual Pressure:	29 PSI
Flow Rate:	982 GPM
Available Flow at 20 psi:	1232 GPM

E. Sprinkler System:

1. This system shall conform to N.F.C. #13 and #14 and I.B.C. Riser may be calculated but shall not be smaller than 6". Sprinkler systems are to be light, ordinary, or extra hazard, as required by NFC-13 and the Utah State Fire Marshall's office.

2. System shall be hydraulically calculated. Sprinkler system shall be light hazard, except for casual ordinary and extra hazard group 1 in storage and service areas. Density for light hazard areas shall be 0.10 gpm per sq. ft. over 1500 sq. ft. Remote area with a maximum head spacing of 225 sq. ft. Service area shall be density of 0.15 over 2000 sq. ft. with maximum spacing of 130 sq. ft.

3. System at rack storage shall be high capacity ESFR heads.

1.5 QUALIFICATION OF DESIGNER

A. Designer shall be an engineering technician or Senior Engineering Technician (Level III or Level IV), NICET certification for fire sprinkler system design.

1.6 QUALIFICATION OF INSTALLER

A. It is intended that the system be designed and installed by a firm regularly engaged in the design and installation business of Fire Sprinkler contracting. The Owner's representative may require evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor who cannot verify such experience, may be found not suitable to perform the work.

PART 2 – PRODUCTS

2.1 HANGERS

A. All hangers to be in accordance with NFPA Pamphlet No. 13.

2.2 RISERS

A. Risers shall be at the locations shown and shall include a U.L. approved control valve, double check valve, flow switch, pressure gauges, water motor gong, or electric bell, standard fire department connection, gate valve supervisory switch, test connections, and drains as required.

B. Fire department connection shall be a duplex type with locking Knox caps per TCSD standards and local Fire Authority requirements.

2.3 SPRINKLER HEADS

A. Sprinkler heads shall be U.L. approved. "K" factors shall be the same on each system and/or floor. See plans for head types. Extended coverage heads will be allowed per NFPA.

B. Sprinklers shall be of the proper temperature rating. Location of sprinkler head wherever reasonably possible shall be symmetrical and coordinated with the ceiling pattern.

C. Number and location of sprinkler heads shown on the drawings are schematic. Exact number and location of heads shall be determined by the system design, and architectural coordination.

D. Provide dry pendent heads in areas subject to freezing, only where wet piping can be run in heated space. Otherwise, provide antifreeze loops.

E. Provide spare head cabinets in accordance with NFPA No. 13 and equip same with at least ten (10) concealed type heads, three (3) upright white heads, six (6) upright brass heads, and appropriate wrenches.

F. Provide head guards in all areas where heads are subject to physical abuse.

2.4 VALVES

A. All valves and fittings shall be listed by Underwriters Laboratories or approved by Factory Mutual for fire protection duty and shall be installed in accordance with their listing and/or approval. Control valve shall have alarm supervisory switches with two sets of contacts and normally open/normally closed.

B. All indicating valves will be of the listed and/or approved type with an electric tamper switch approved for use with that valve.

C. Water hammer arrestors shall be provided ahead of all automatic valves to eliminate water hammer and shall be installed vertically in an accessible location.

D. Hose valves off standpipes shall be U.L. approved. All valves shall be 2-1/2" with 2-1/2" X 1-1/2" reducer and cap with chains. Valves shall be polished brass and chrome plated.

2.5 PIPING

A. All piping above ground shall be Schedule 40 domestic steel pipe and fittings.

B. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

2.6 PIPING SUPPORT

A. Steel roof deck shall not be used to support loads from fire piping or equipment of any kind, unless specifically noted otherwise.

B. Bracing of miscellaneous items (fire, mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.

C. It is essential that all piping be supported from roof structure at joist within 6” of panel point location and from top or bottom chord of floor or roof joist.

2.7 EARTHQUAKE BRACING

A. Install earthquake bracing in accordance with NFPA #13 Standards and Utah State Fire Marshall's Office.

2.8 SLEEVES

A. Sleeves shall be furnished, together with their location and elevations to the construction manager, timely with required schedule or concrete pours. If sleeves are missed by this contractor, he shall be responsible for core drilling thru concrete at his own expense, and he shall be responsible for his cutting and patching. Sleeves shall be of the size, type, and length required by N.F.P.A. codes. See Section 230900 for "Sleeves".

B. Sleeves shall be placed in structural members only where approved by the Owner's representative.

C. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

D. Sleeves thru Finished Surfaces:
For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

1. Sleeves thru Fire-rated Surfaces:
All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes have been placed with a U.L. listed fire safing system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.

2. Sleeves thru Sound Rated Surfaces:
   All pipe sleeves and ductwork penetrating sound rated walls or surfaces shall be packed with dense fiberglass, sealed with duct sealer and fitted with metal cover flanges on both sides.

3. Sleeves thru Floors:
   Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

E. All penetrations must be sleeved or core drilled/cut. Hammer drill is not an acceptable means.

PART 3 – EXECUTION

3.1 TEMPORARY FIRE PROTECTION DURING COURSE OF CONSTRUCTION

A. This contractor shall provide fire protection as required by N.F.C. #14 - Chapter 8 and shall be coordinated with the local fire department.

3.2 SHOP DRAWINGS

A. Shop drawings, submittals, and hydraulic calculations, as necessary and required, shall be submitted to the Owner's representative for approval prior to incorporating materials or equipment into the work. Shop drawings shall be complete and in accordance with N.F.C. #13, #14, #20, and all applicable standards, submittals, and equipment, valves, flow switches, controls, and other important items shall be complete, showing details, description, and characteristics; hydraulic calculations shall be based on the water system fire flow capacities shown on the drawings and shall show flows, pressures, velocities, pipe size, and equivalent lengths as required for the system.

B. Calculations shall be arranged in an orderly manner with sufficient reference points for the approving authority to review and approve.

C. Testing shall be accomplished by this contractor for all required systems, equipment, and appurtenances, as required by the various standards and codes. The Owner's representative shall witness and sign off each item required. This contractor shall furnish required forms.

3.3 TESTS

A. Install all test pipes and valves as required by NFPA No. 13. Locate inspector's test valves and auxiliary drain valves above ceilings in areas approved by the Architect and provide hose bibb connections. Conduct all tests as required by NFPA Standards and Insurance Services Office and submit copies of completed test forms to the building owner.

B. All fire sprinkler related tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness or documentation, then they will be run late and all damage caused by the system or caused in uncovering the system for such tests will be borne by this contractor.

C. The Utah State Fire Marshall and building owner shall be notified (in writing) at least three days in advance of the following:

1. Hydrostatic test and final inspection of the underground, prior to backfilling.
2. Flushing of underground prior to connection to overhead.
3. Hydrostatic test and final inspection of overhead, prior to the installation of the ceilings.

3.4 GENERAL REQUIREMENTS

A. This contractor shall submit complete drawings, hydraulic calculations, and proper documentation to the local authority having jurisdiction and receive their approval before submitting such material to the Owner's representative for final approval. The contractor will be required to show proof of submittal to the Owner's insurance underwriter and local building authorities before installation may begin.

B. All work of this contractor will be coordinated with other trades to insure minimal changes to the sprinkler system from the designs. Careful coordination of mechanical and electrical ducts, pipe and conduit shall be required. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing waste, rainwater, and soil lines' supply, return, and exhaust ductwork; water piping; fire protection piping; and pneumatic control piping.

C. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, the lights, and diffusers and grilles and as shown on the Architect's reflected ceiling plan. Offsets shall be made in piping to accommodate ductwork in ceiling. Heads should be symmetrical, and all piping run parallel or perpendicular to building lines. In no case shall sprinkler heads be installed closer than 6" from ceiling grids or closer than approved distances from ceiling obstructions.

D. All sprinkler piping shall be run concealed unless approved by the Owner's representative. All lines will be run as high as possible so as to not interfere with future changes to ceiling heights or other mechanical equipment. This contractor will be responsible for all sleeves, core drills, and sealing of penetrations in walls, floors, and structural members to facilitate the installation of the system, however, no holes in, or attachments to structural members will be allowed unless approved by the Owner's representative.

E. All required drains and test pipes will be installed and finished in a workmanlike manner, terminating at a proper location to accommodate the required outflow without damaging the building or landscaping. Drain and test pipe locations shall be approved by the owner's representative.

F. All piping, and heads located in un-heated spaces shall be installed with a glycol loop system. Coordinate location with the owner's representative. Indicating valves with tamper switches shall be installed and wired as required by code. Coordinate with electrical contractor.

G. No piping or valve assemblies shall be run exposed in a finished area without the prior approval of the owner's representative.

3.5 JOB CLOSEOUT

A. This contractor shall assure that all placards, signs, and instruction manuals are in place, and all tests are run before any consideration for final payment will be considered. This includes maintenance manuals, hydraulic calculations placards, spare head cabinets and the proper number of spare heads, and instruction to on-site personnel.

B. This contractor shall, in addition to the above, furnish the owner one (1) set of mylar reproducibles of the sprinkler system "record drawings" for his project files.

END OF SECTION

Craig Blue, P.E. Inc.
Fire Suppression
Engineering & Testing

1971 West 3300 South, #A
West Valley City, UT 84119
801-886-3473
Craig@CBluePE.com

Fire Flow Report

CBPE # 1050-46
Date: 1/14/2020

This report contains the assessment of the water supply available for fire protection at the following site/address:

Tooele School District
Old Army Depot
Bldg 647, 115 S. Iron Steet
Bldg 649, 180 Garnet Street
Tooele, Utah

Report was prepared at the direction of:

Michael Garcia
Tooele School District
Tooele, UT

Prepared by:

Craig Blue, P.E.

Background Information:

The purpose of this report is to determine the amount of water supply available at the site noted above. The report shall assist authorities having jurisdiction, in determining fire suppression requirements & issuing of building permits. Comments included in report, that references 2018 International Building/Fire code are based on minimum recommended standards only. The authorities having jurisdiction may require more or less than the reference appendix.

Water & Hydrants to site are supplied from Tooele Water & Depot- water system. Water system uses PRVs and elevated tanks for system pressure. Pressures and flows are consistent throughout seasons being located below the pressure reducing stations. Hydrants selected were nearest to site. water main in area is noted as 6" looped with larger supplies throughout Depot.

Flow Test:

The flow test was performed by Craig Blue P.E. & Jack Cochrane. (1/14/2021) Water flow and pressures available at hydrants nearest to site are as follows:

Static Pressure:	55psi
Residual Pressure:	32psi
Flowing 2.469" Two outlet (9 psi-pitot):	982 gpm
See flow data sheet for site plan, and hydrants reference.	
Hydrants elev.	4830 ft. approx..
Fire flow calculated for performance	1232 gpm at 20 psi,

Both buildings are existing single story storage bldgs from 1940's era. The existing buildings and total area are not know at this time. FR Wall separations are not know at this time. Existing structures are type V-B and typically provided with fire sprinklers. Fire riser rooms are located near hydrants along Roadway. Bldgs are used for vehicle maintenance and storage. No change to S-1 occupany

New remodel or existing structure shall be provided with fire sprinklers throughout. Per table B105.2 exception, the fire flow may be reduced by 75% when fire sprinklers are provided. The fire flow of 1232 gpm allows for a maximum 29,300 sq.ft. Fire flow. Note- Existing Bldg and no change to S-1occupancy.

Summary & Recommendations:

It is our opinion, that fire flow performance near site is marginal for existing structures noted. Static pressures are stable due to two PRV supplies to site.

For the purpose of fire sprinkler design, the area is an established area which is considered reliable.

Design of fire sprinklers should use a 10% reduction to accommodate for safety margins for seasonal fluctuations. Reduced pressures shall be as noted.

Static Pressure:	50 psi
Residual Pressure:	29 psi
Flowing	982 gpm

See flow data sheet for site plan, and hydrants reference elevations.

If there are further questions, please contact me

Craig Blue,P.E.

Attached:

Flow Data Sheet & Chart
Referenced IFC code sections.

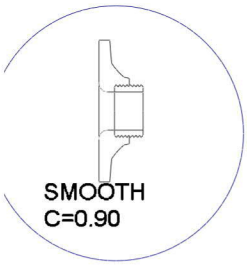
FLOW TEST DATA SHEET

Craig Blue P.E. Inc.
Fire Suppression Engineering & Testing
801-886-3473 Craig@CBluePE.com

CBPE: 1050-46

OUTLET TYPES:


PLAY PIPE
C=0.97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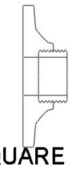
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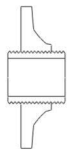

PROJECTED
C=0.70

WATER SYSTEM: Tooele Water System
NAME OF PROPERTY: Tooele School District Bldg 647 & 649
ADDRESS: 115 Iron st. & 180 s. Garnet H ave and Halight
Tooele , UT
DATE: 1/14/2021 TIME: 1:00 pm TEMPERATURE: +40°F
TYPE OF CITY SYSTEM: PRVs - 6" looped- two feeds.
TEST CONDUCTED BY: Craig Blue PE.
WITNESSED BY: Jack Cochrane Tooele Fire
NOTES:

FORMULA Q=29.83 C D^2 P^.5

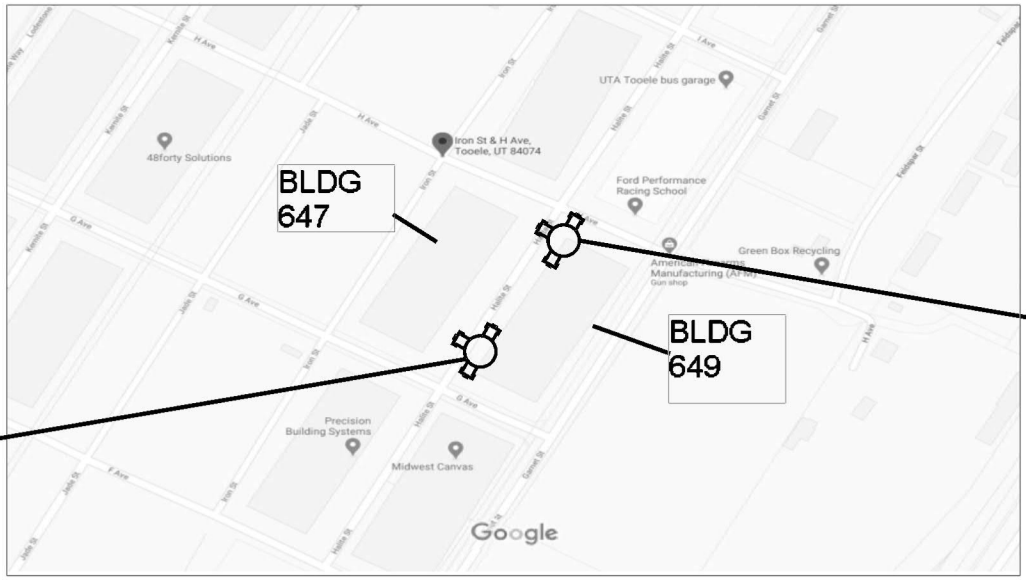
WHERE Q IS GALLONS PER MINUTE
C IS THE COEFFICIENT OF DISCHARGE
D IS I.D. IN INCHES OF OUTLET (2.469" typ.)
P IS PITOT GAUGE READING (PSI)

	SIZE (IN)	PITOT (PSI)	FLOW (GPM)
OUTLET 1	2.469	9	491
OUTLET 2	2.469	9	491
OUTLET 3			
OUTLET 4			

FIRE FLOW: 1232 gpm @ 20psi TOTAL FLOW: 982

STATIC: 55 PSI RESIDUAL: 32 PSI ELEVATION: 4830 hydrant elev.

SKETCH AREA MAP BELOW:



NORTH

HYDRANT:
55 psi Static
32 psi Residual

HYDRANT:
18 psi
pitot(2.469"-c.90)
2- outlets
Flowing 1743 gpm

FLOW TEST DATA CHART

Craig Blue P.E. Inc.
Fire Suppression Engineering & Testing
801-886-3473 Craig@CBluePE.com

CBPE: 1050-46

WATER SYSTEM: Tooele Water System

NAME OF PROPERTY: Tooele School District Bldg 647 & 649

ADDRESS: 115 Iron st. & 180 s. Garnet H ave and Halight
Tooele , UT

SUPPLY:	55 PSI	32 PSI	982 GPM	1232 GPM	4830 ft grade
	STATIC	RESIDUAL	FLOWING	FIRE FLOW at 20 psi	GRADE ELEV.

DATE OF TEST: 1/14/2021

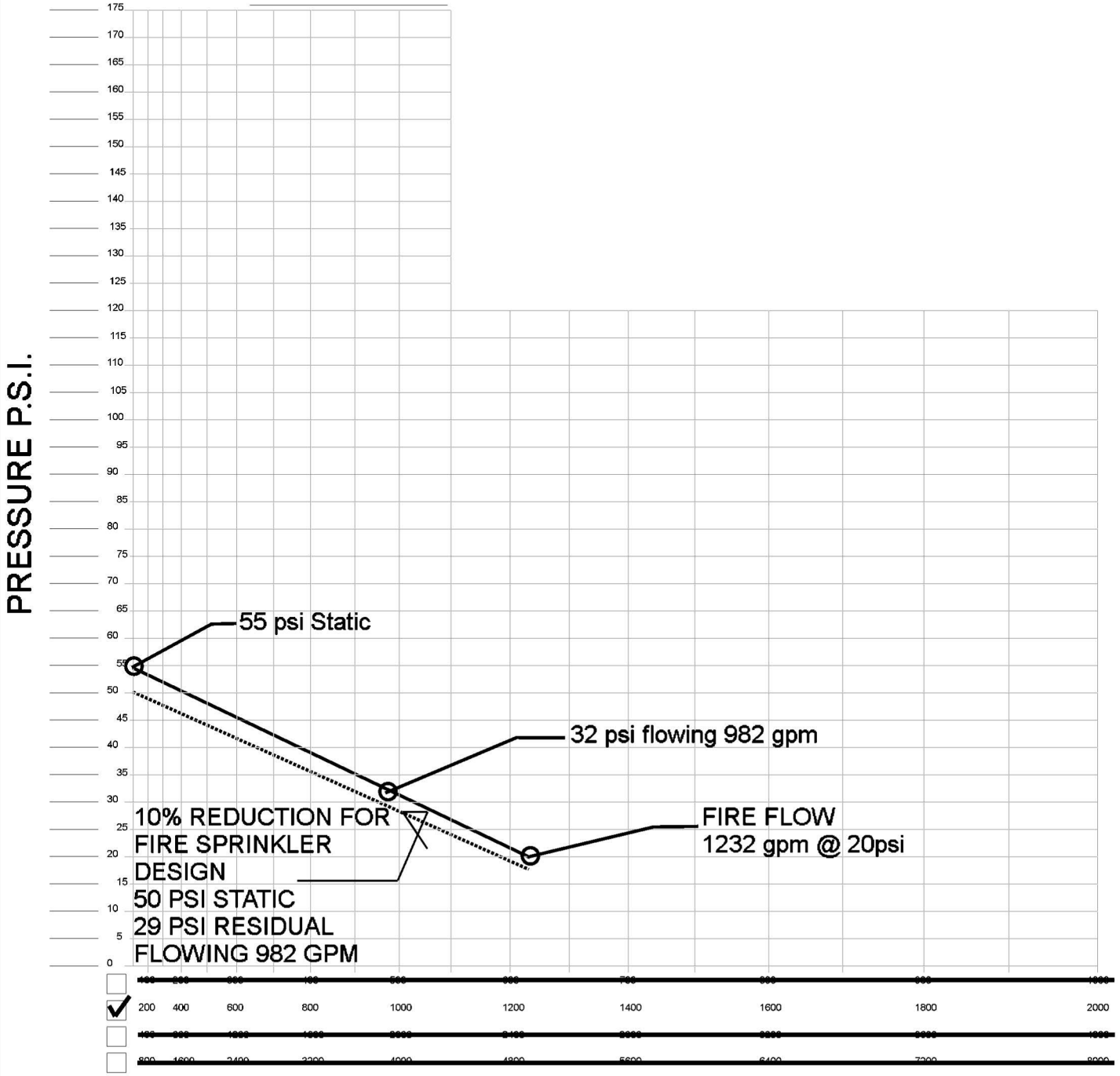


CHART #1

doors shall not be obstructed or eliminated. Exit and *exit access* doors shall comply with Chapter 10. Access doors for *high-piled combustible storage* shall comply with Section 3206.7.

504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3-percent slope), shall be provided with a *stairway* to the roof. *Stairway* access to the roof shall be in accordance with Section 1011.12. Such *stairway* shall be marked at street and floor levels with a sign indicating that the *stairway* continues to the roof. Where roofs are used for roof gardens or for other purposes, *stairways* shall be provided as required for such occupancy classification.

SECTION 505
PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of $^1/_2$ inch (12.7 mm). Where required by the *fire code official*, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with *approved* signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an *approved* size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506
KEY BOXES

506.1 Where required. Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the *fire code official* is authorized to require a key box to be installed in an *approved* location. The key box shall be of an *approved* type listed in accordance with UL 1037, and shall contain keys to gain necessary access as required by the *fire code official*.

506.1.1 Locks. An *approved* lock shall be installed on gates or similar barriers where required by the *fire code official*.

506.1.2 Key boxes for nonstandardized fire service elevator keys. Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:

1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and *approved* by the *fire code official*.
2. The front cover shall be permanently labeled with the words "Fire Department Use Only—Elevator Keys."
3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.
4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.
5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted where authorized by the *fire code official*.
6. In buildings with two or more elevator banks, a single key box shall be permitted to be used where such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).

Exception: A single key box shall be permitted to be located adjacent to a *fire command center* or the nonstandard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.

506.2 Key box maintenance. The operator of the building shall immediately notify the *fire code official* and provide the new key where a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507
FIRE PROTECTION WATER SUPPLIES

507.1 Required water supply. An *approved* water supply capable of supplying the required fire flow for fire protection shall be provided to premises on which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be determined by an *approved* method.

507.4 Water supply test. The *fire code official* shall be notified prior to the water supply test. Water supply tests shall be witnessed by the *fire code official* or *approved* documentation of the test shall be provided to the *fire code official* prior to final approval of the water supply system.

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an *approved* route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the *fire code official*.

Exceptions:

1. For Group R-3 and Group U occupancies, the distance requirement shall be 600 feet (183 m).
2. For buildings equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the distance requirement shall be 600 feet (183 m).

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30 480 mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30 480 mm) where *approved* by the *fire code official.*

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the *fire code official*. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, *alterations* and servicing shall comply with *approved* standards. Records of tests and required maintenance shall be maintained.

507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with NFPA 25 at the following intervals:

1. Private fire hydrants of all types: Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or *approved*.

507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other *approved* means shall comply with Section 312.

SECTION 508
FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code*, a *fire command center* for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.6.

508.1.1 Location and access. The location and accessibility of the *fire command center* shall be *approved* by the *fire code official*.

508.1.2 Separation. The *fire command center* shall be separated from the remainder of the building by not less than a 1-hour *fire barrier* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assembly* constructed in accordance with Section 711 of the *International Building Code*, or both.

508.1.3 Size. The *fire command center* shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m^2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater.

508.1.4 Layout approval. A layout of the *fire command center* and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the *fire command center* shall be prohibited.

508.1.6 Required features. The *fire command center* shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking *interior exit stairway* doors simultaneously.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: *Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the* International Building Code®.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The *fire code official* is authorized to reduce the *fire-flow* requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full *fire-flow* requirements is impractical.

B103.2 Increases. The *fire code official* is authorized to increase the *fire-flow* requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code.*

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The *fire-flow calculation area* shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings that are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate *fire-flow calculation areas.*

B104.3 Type IA and Type IB construction. The *fire-flow calculation area* of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: *Fire-flow calculation area* for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.2 and B105.1(2).

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an *approved automatic sprinkler system*, the water supply shall be capable of providing the greater of:

1. The *automatic sprinkler system* demand, including hose stream allowance.
2. The required *fire flow*.

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. Types of construction are based on the *International Building Code*.
b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.
a. The reduced fire flow shall be not less than 1,000 gallons per minute.
b. The reduced fire flow shall be not less than 1,500 gallons per minute.

SECTION B106
REFERENCED STANDARDS

ICC	IBC—18	International Building Code	B104.2
ICC	IWUIC—18	International Wildland-Urban Interface Code	B103.3
ICC	IRC—18	International Residential Code	Table B105.1(1)
NFPA	1142—17	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

DIVISION 22 – PLUMBING

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SECTION 22 0000

PLUMBING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Piping diagrams are schematic and indicate preferred pipe routing. It is the intent that the installation be complete. Where fixtures are not shown connected to any required services, they shall be connected properly and completely. Connect all fixtures to various services, i.e., hot water, cold water, waste, and vent, etc., as required.

B. The work shall include furnishing of all materials and labor required for the job as described, together with all accessories and trim implied or required to finish the work, and generally as follows:

1. Plumbing fixtures and piping.
2. Water heaters circulating pumps.
3. Sanitary sewer systems.
4. Condensate drain systems.
5. Final connections to site utilities.

1.2 STANDARDS

A. Plumbing installation shall be made in accordance with the current International and State Plumbing Code, City Code, and all other governing codes.

B. In the event drawings violate the codes as being locally enforced, the contractor shall base his estimate on the enforced code requirements.

1.3 VERIFICATION OF GRADE

A. The contractor shall verify with the site utilities contractor the connection of water and waste piping systems to the mains and shall verify the actual job site elevation and location prior to the installation of the building footings.

1.4 VERIFICATION OF INSTALLATION

A. At time of final inspection contractor shall provide a color video tape of all new 3" and larger buried storm sewer and sanitary sewer lines both inside and outside to 5'-0" beyond the building line as well as lines 5'-0" beyond the sampling manhole.

B. Video must be taken after installation is complete to ensure that line is installed properly with no low spots, separations, etc. Video shall also ensure that all connections have been made properly and that no debris remains in piping system. Building owner shall be notified to witness videotaping.

1.5 DISINFECTING

A. After flushing the mains, introduce a water and chlorine solution concentrated to 300 PPM to disinfect the system and oxidize piping contaminates. Retain treated water and chlorine for a period of not less than three hours or more than six hours before final flushing out of system.

B. All valves should be opened periodically during the process and the residual chlorine checked to ensure that at least 50 percent of the initial concentration is present to complete the disinfection. If there is less than 50 percent, the valves should be allowed to drain water until the 50 percent or greater level is obtained. A make-up chlorine solution of a concentration equal to the initial concentration must be added as needed during the withdrawal of the spent solution.

C. A warning sign shall be conspicuously posted at each water outlet and faucet during the disinfecting process to prevent occupants from drinking the water.

D. Flushing: Following disinfection, all treated water shall be flushed from the system through its extremities. Flushing shall continue until samples show that the quality of the water delivered is comparable with the quality of the public water supply and satisfactory to the public health authority having jurisdiction. Flushing shall be repeated if samples taken daily over a period of three days show the water quality is not being maintained. Samples shall be taken only from taps located and installed in such a manner that they will not contribute any contamination. Samples shall not be drawn from hydrants or through unsterilized hose. Test samples shall be certified by a recognized and approved testing laboratory, and a certificate of acceptability shall be submitted.

E. Written certification of the disinfecting process and purity of water samples shall be forwarded to the Owner's representative.

PART 2 – PRODUCTS

2.1 CLEANOUTS

A. Approved cleanouts shall be installed in the base of each vertical drainage line, and in the horizontal line at each change in direction. In addition, there shall be cleanouts spaced at a maximum of 50' in all horizontal lines. All cleanouts shall be extended to accessible surfaces. **No cutting of millwork or supports will be allowed.**

2.2 WATER HAMMER

A. Provide and install stainless steel bellows type shock absorbers in the ends of all multiple fixture water lines and in piping ahead of snap-acting automatic valves.

B. Absorbers shall be sized and located in compliance with manufacturer's recommendations for the specific application. Absorbers shall be Zurn, Wade, or Smith.

C. Absorbers shall not be installed in inaccessible areas. Extend piping to accessible locations.

2.3 FLASHINGS

A. All pipes passing thru the roof shall be neatly flashed with watertight 4# sheet lead flashing with lead rain collar with clamping collar or as required by roofing manufacturer fitting snugly around the pipe, extended to the top and finished with a code-approved vent cap. The flange around the base shall be at least 18" square. Flashings shall be provided by Division 220000.

2.4 PLUMBING FIXTURES

A. This contractor shall furnish and install all fixtures shown on the architectural or mechanical drawings or specified hereinafter, clean and adjust all fixtures and replace any damaged fixtures at the contractor's expense.

B. The fixtures shall be all new and complete as shown and described in manufacturer's catalog, and as required for the work, including accessible loose key 1/4 turn ball type stops above the floor in supplies to all fixtures, and cast brass P-traps, unless otherwise shown. Trim for all fixtures shall be chrome-plated, and all trim shall match in design. Supply faucets shall have renewable seats and barrels. Fixtures shall be Kohler, American Standard, Crane, Watts, or approved equal.

Approved Fixtures:

Water closets, urinal & lavatories:	Kohler, American, Standard, Crane, or approved equal.
Flush valves:	Zurn, Sloan, or approved equal.
Sinks:	Just, Elkay, or approved equal.
Faucets:	Moen, Kohler, American Standard, or approved equal.
Drinking fountains:	Murdock, Acorn, Elkay, or approved equal.
Shower trim:	Symmons, Bradley, T&S Brass, Moen, or approved equal.
Hose bibs:	Watts, Zurn, JR Smith, Woodford, or approved equal.
Emergency fixtures:	Bradley, Symmons, Haws, or approved equal.
Tempering Valves:	Bradley, Symmons, Watts, or approved equal.
Floor drains, floor sinks:	Zurn, JR Smith, Watts, Josam, or approved equal.

PLUMBING FIXTURES

WC-1	Water Closet:	Kohler K-4368 "Highcliff" siphon jet, floor-mounted, extended lip bowl, 1-1/2" top spud, vitreous china, Toto sensor 1.6 #TETIDNC-32 battery powered flush valve and battery or Zurn equivalent. K-4666-C "Lustra" extra heavy solid plastic white open front seat with stainless steel check hinge; 431310-100 bolt caps.
U-1	Urinal:	Kohler #K-4960-ET "Barton" vitreous china, wall hung, siphon jet with flushing rim, 2" outlet connection, 3/4" top spud with Toto sensor #TEUIDNC-22 battery powered sensor operated chrome plated flush valve with vacuum breaker and battery or Zurn equivalent, plate type carrier and bearing plate. Wade W-452, Zurn 1222, Smith 633.
L-1	Lavatory: (ADA)	Kohler K-2032 "Greenwich" 20" x 18" - 4" center set vitreous china, front overflow, anti-splash rim, center basin, wall hanger, punched for concealed arm carrier, Moen 8210 dual lever ADA faucet, grid strainer, tailpiece and flexible supplies w/stops and brass P-trap. Support lavatory with Zurn ZN1231 concealed arm carrier with foot support. Provide ADA insulation kit.
F-1	Faucet:	Chicago Faucet No. 897-C-CP polished chrome faucet with vacuum breaker & hose end. Coordinate mounting location and height with owner prior to rough-in.
SS-1	Service Sink: (Floor type)	Kohler K-6710 "Whitby" 28" x 28" service sink, floor mounted, drain channels; Chicago Faucet No. 897-C-CP polished chrome faucet with vacuum breaker, hose end with hose, bucket hook, wall brace integral stops. Faucet to be mounted 30" above finish floor; K-8940 rim guard; K-9146 drain with strainer for 3" connection.

ESH-1	Emergency Shower/Eyewash	Bradley S19-310 BF combination emergency shower/eyewash, barrier free, 10" dia. Shower head, 10" dia. Eyewash bowl, 1" stay open ball valve with stainless steel shower pull rod, 1/2" stay open ball valve with pvc push handle.
TV-1	Tempering Valve:	Watts Model USG-B ASSE 1070 single lavatory mixing valve with integral strainer.
TV-2	Tempering Valve: (Combination EWS)	Bradley s19-2200 emergency fixture thermostatic mixing valve, adjustable set point, built-in cw bypass, dial thermometer, positive shut-off of hot supply when cold supply is lost. 1” inlets and 1-1/4” outlet, to mix cold water with 120d F. hot water for 75d F. tempered water supply. Manifold shall be complete with temperature gauge, inlet check stops, and cold-water bypass.
HB-1	Hose Bibb:	Zurn Z-1310 3/4" "Ecolotrol" non-freeze anti-siphon wall hydrant with bronze casing and plain bronze face, provide with loose key and set screw for each hydrant. 18” minimum length required.
HB-2	Hose Bibb:	Zurn Z-1330 Encased Ecolotrol "anti-siphon" wall hydrant, for interior wall installation. Complete with integral backflow preventer, all bronze interior parts, non-turning operating coupling with hemispherical neoprene plunger and 3/4" solder inlet. Stainless steel box and hinged cover with operating key lock and "WATER" stamped on cover.
WB-1	Washer Box:	Guy Gray WB-200 "Duo-Cloz" for on-the-wall installation with concealed piping, dual 1/2" ball valves with single level on-off control and hose connections. Rough chrome plate finish. (Verify mounting height with existing conditions). Provide 1-1/2" standpipe drain with P-trap for waste connection.
FD-1	Floor Drain:	Zurn #Z-415-4 2" cast iron drain with nickel bronze top. Drain to have deep seal P-trap with ASSE trap guard.
FS-1	Floor Sink:	Zurn ZN-1900-4" sanitor floor sink with 12" x 12" square top, full removable grate with center opening. N.B. dome, sani-coated exterior, acid resistant enamel interior, and Z-100 deep seal trap. Sink shall be complete with slotted stainless-steel sediment bucket, full grate, 3/4 grate, 1/2 grate, etc. as necessary to match application. Sink to be installed flush with floor or as required by local codes.

2.5 WATER HEATER: (WH-1)

A. Water heater shall be natural gas fired, high efficiency w/ AGA approved gas train.150,000 BTUH input with 176 GPH recovery thru 100 deg. F. temp. 3” PVC vent and air intake with factory roof termination kit. 100-gallon glass lined ASME:"H" stamp vertical storage tank with pressure and temperature relief valve, insulated jacket with baked enamel finish, complete with all controls for automatic operation. Heater shall be designed for 120 deg. F. operation. 120/1/60 power.

Make & Model:	Bradford White EF-100T-150E or A. O. Smith or Rheem equivalent
Nominal Size:	28-1/4" Dia. x 74-1/4”H

B. Water heaters and storage tanks shall be PVI, State, Bradford White or approved equal.

2.6 LEAD PANS AND WATERPROOF MEMBRANES

A. Division 220000 shall furnish a 30" square 4# lead flashing with vent and/or pipe penetration of roof. Coordinate with roofing contractor.

B. All floor drains shall be fitted with clamping collar and waterproof membrane.

C. Membrane and lead waterproofing pans for built-up type custodial floor sinks shall be installed by plumbers so they are 100% watertight. Drains shall have clamping device which clamps drain to pans. There shall be a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened, there is a complete watertight seal.

D. Care should be taken not to clog weep holes. All pans will be tested by placing test plug in drain and filling with water overnight.

2.7 VACUUM BREAKERS & BACKFLOW PREVENTERS

A. Vacuum breakers and backflow preventers shall comply with requirements of the Utah State Plumbing Code for the actual installed duty.

B. Vacuum breakers and backflow preventers shall be of the type, style, and arrangement approved by the Code.

C. All vacuum breakers and backflow preventers shall be installed with the necessary isolation valves and test cocks.

2.8 CIRCULATORS

A. Furnish and install the circulators shown and specified on the drawings. Circulators shall be of the in-line, pipe-mounted, motor driven, centrifugal type. All motors shall operate at 1750 RPM. Circulators shall operate at high efficiency and shall have a quiet, vibrationless operation. Provide steel support for motor. All circulators to be all bronze construction.

B. Circulators shall be Bell & Gossett, Armstrong, or Taco.

2.9 CONDENSATE DRAIN

A. All refrigerated air conditioning and/or cold storage cases which have cooling coil condensate drip pans with pipe connections shall be piped to the nearest drain by this contractor.

B. Pipe location and routing shall be approved by the owner's representative.

C. Piping shall be the same size as the drain pan connection and shall be trapped to prevent forced air flow thru the pipe.

2.10 CONDENSATE LIFT PUMPS

A. See Division 233000 for lift pump requirements for heat pumps.

PART 3 – EXECUTION

3.1 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect plumbing materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

3.2 TESTING

A. Furnish all required personnel and equipment and make all tests required to receive the approval of the Owner and all agencies having jurisdiction.

3.3 CLEANING UP

A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

3.4 WATER CLOSET INSTALLATION

A. General: Install water closets as shown on the drawing and as follows:

1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
2. Additional wall plates shall be provided where each pipe extends through finished wall.
3. Two rubber or plastic seat bumpers with metal holders shall be provided and secured to the wainscot behind the fixture.
4. The centerline of the flush valve shall be on the centerline of the fixture, 39 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
5. Chrome plated pipe support shall be provided on the long flush pipe outlet and shall be secured rigidly to the wall with suitable anchors.
6. The backflow preventer for the flush valve shall be installed at the discharge of the valves.
7. The flush valve water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium plated spacer sleeve and wall flange.

3.5 URINAL INSTALLATION

A. General: Install urinals as shown on the drawing and as follows:

1. Supply pipe extending from wall shall be covered by chrome plated sleeve and wall flange.
2. Additional wall plates shall be provided where each pipe extends through finished wall 45 inches above the finished floor and a minimum of 2-1/4 inches from the wall.
3. The centerline of the flush valve for handicap urinals shall be 40 inches or less above the finished floor.
4. The backflow preventer for flush valve shall be installed at the discharge of the valve.
5. The flush valve and the water piping concealed in the partition shall be rigidly supported; piping between flush valve and wall shall be provided with a factory fabricated chromium-plated spacer sleeve and wall flange.

3.6 LAVATORY INSTALLATION

A. General: Install lavatories as shown on the drawings and as follows:

1. Lavatories for use by wheelchair handicapped shall be installed with a minimum rim height of 34", a minimum vertical clearance of 29" from floor, and a minimum clear knee recess of 30" in width and 20" in depth.
2. Trap on lavatory for use by wheelchair handicapped shall be installed so as to provide maximum clearance under bowl. Exposed waste, trap and hot water supply under lavatory shall be insulated in accordance with Division 220700.
3. Mount lavatories as required by code and architectural elevations.

3.7 FIXTURE CONNECTIONS

A. Floor Mounted Water Closets and Service Sinks: Provide connections between soil pipes and floor connected water closets and service sinks made with cast-iron floor flanges.

B. Connection sizes shall be 4-inch for water closets and 3-inch for service sinks.

C. Floor flanges shall be slipped over the ends of the pipes and caulked in position.

D. Special short radius fittings shall be used where space does not permit the use of standard fittings below the flanges.

E. Setting Compounds and Gaskets: Provide watertight and gas tight seals between flanges and fixtures with plumbing-fixture-setting compound or manufacturer's standard non-asbestos gaskets.

F. Neither rubber gaskets nor putty shall be used in sealing connections.

3.8 FIXTURE SUPPORTS

A. Lavatory Support: Provide lavatory chair carriers consisting of a pair of cast-iron feet bolted to or imbedded into the floor together with 1.66- inch (minimum) steel tubular upright members, a horizontally adjustable alignment truss or tie rod at bottom and another at the top connected to cast-iron or steel adjustment sleeves and painted cast-iron or steel adjustment sleeves, and painted cast-iron concealed arms.

3.9 INSTALLATION OF PRESSURE REDUCING VALVES

A. General: Install one or more pressure reducing valves on the main water line supplying plumbing fixtures.

1. Provide each pressure reducing valve with a gate valve and union on both the inlet and outlet connections.
2. A bypass one pipe size smaller than the main water line provided with a globe valve and union, shall be installed between the inlet and outlet sides of the pressure reducing valve assembly.
3. Pressure gauges shall be installed at the inlet and outlet connections to the pressure reducing valve assembly. Gauges shall have T-handle stops in their connections.

3.10 STRAINER INSTALLATION

A. General: Place strainers ahead of pressure reducing valves, automatic control valves, pumps, and elsewhere as indicated on the drawings or specified.

3.11 BACKFLOW PROTECTION VALVE INSTALLATION

A. General: The entire water distribution system shall be protected against contamination due to backflow from non-potable sources. Each connection to a fixture or an item of equipment shall be protected in accordance with the requirements of the International Plumbing Code.

B. Reduced Pressure Zone Backflow Preventer: Install a reduced pressure zone backflow preventer in the building water supply main to expansion tanks, condenser water systems, and boilers as shown on the drawings and/or as required by the local codes.

3.12 INSTALLATION OF PIPE SLEEVES

A. Basic Requirements: Install pipe sleeves as follows:

1. Pipe sleeves shall be provided for all pipes passing through walls, slabs on grade and floors. Sleeves may be omitted where pipes pass through exterior walls above ground to wall hydrants and downspout nozzles.
2. Sleeves for pipes passing through exterior walls and slabs on grade which do not have membrane waterproofing shall be of cast-iron or galvanized steel pipe or black steel pipe, Schedule 40.
3. Sleeves for pipes passing through exterior walls, slabs on grade and floors which are provided with membrane waterproofing shall be of threaded galvanized steel pipe fitted with companion flanges and arranged to secure membrane. Companion flanges shall be drilled and tapped in such a manner that bolting is affected from the outer (or upper) face only.
4. Sleeves for pipes passing through potentially wet floors that do not have membrane waterproofing such as in toilet rooms, cafeteria kitchens, serving areas, dishwashing rooms, utility cores, mechanical equipment rooms, and areas that are provided with fire protection sprinkler systems, shall be galvanized steel pipe, shall project 2 inches above the finished floors, and shall be caulked watertight.
5. Sleeves for pipes passing through all other floors and walls shall be constructed of galvanized or black steel pipe, standard weight.
6. Sleeves shall be built into the walls and floors as the work progresses.

3.13 INSTALLATION OF CLEANOUTS AND FERRULES

A. Riser Connection to Sewer or Drain: Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main. **Cutting of millwork or supports will not be allowed.**

B. Test Tees: Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.

C. Cover Plates: Where cleanouts or test tees occur on concealed pipes in finished rooms, they shall be provided with a 1/8-inch thick, machine finished, brass cover plate of sufficient diameter to cover the opening in the finished wall or partition. The cleanout plug shall have a solid head, tapped for a 1/4-inch brass screw to secure the cover plate. Where cleanout plugs extend beyond the wall finish, the cover plates shall be of machine finished brass and shall be only of sufficient depth to fit against the wall to cover plug. Cleanout cover plates shall be painted to match adjacent wall finish. **Cutting of millwork or supports will not be allowed.**

D. Cleanouts Plugs for Threaded Fittings: Cleanout plugs for threaded fittings shall be in accordance with ANSI B16.12. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4 inches; cleanout plugs for piping 4 inches and smaller shall be the same size as the pipe.

E. Cleanout Plugs for Hub-and-Spigot Fittings: Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with ANSI B16.12, except that plugs required to be flush with the floor shall have square countersunk heads in lieu of raised heads.

F. Cleanout Plugs for Copper Drainage Lines: Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

3.14 WATER PIPING INSTALLATION

A. General: Water piping shall be complete from service connection to all fixtures and equipment outlets. Sizes of pipes shall be as shown or specified.

B. Reaming: Ends of pipes and tubes shall be reamed before being made up.

C. Threaded Joints: Threaded joints shall be made up metal-to-metal, with a noncorrosive lubricant applied to the male thread only. Lampwick or other packing material shall not be used in making up threaded joints.

D. Chromium Plated Piping: Chromium plated piping shall be threaded and made up carefully, and not more than one full turn of thread shall be exposed beyond any fittings.

E. Long Screws and Bushings: Long screws and bushings (other than bushings cast in the sand) shall not be used on water piping.

F. Soldering: Ends of tubing and recesses of fittings to be soldered shall be thoroughly cleaned. Joints shall be assembled without binding. Solder shall penetrate fully and shall fill the joint completely. Joints shall be made using lead-free solder, as specified.

G. Joint Materials: All joint materials shall be free from oil, tar, and greasy substances, and shall be dry when placed in the joint. The material shall be handled with care to prevent contamination.

H. Copper Tubing: All copper tubing shall be free from cuts, dents or other surface damage at the time of final inspection. Damaged tubing shall be removed and replaced with new.

I. Copper Tube Anchoring: Horizontal runs of copper tubing over 50 feet in length shall be anchored to wall or floor construction. Anchors shall be located near the midpoints of the runs so as to force the expansion equally to the ends or in a direction where expansion can take place without excessive strain.

J. Swing Joints, Offsets, and Expansion Joints: Swing joints, offsets, and expansion joints shall be provided where necessary to accommodate expansion of piping, which will be approximately two inches in 100 feet of copper hot water piping.

K. Dielectric Couplings: Where non-ferrous metal piping and zinc-coated metal piping are joined, dielectric (insulating) couplings, fittings or unions shall be provided.

L. Reducing Fittings: Where pipe sizes shown or specified differ from the connection sizes of meters, pumps, fixtures, outlets, and the like, reducing fittings shall be installed close to them.

M. Pipe Branches: Branches from water supply mains shall be taken from the top, bottom or side, using crossover fittings where required by structural or operating conditions.

N. Upfeed Hot Water Return: On upfeed hot water distribution systems for which return circulation piping is shown, a 1/2" circulation connection shall be made at a point on each riser just below the highest outlet connection. Provide branch circulation lines with gate valves near the valves on corresponding supply lines.

O. Downfeed Hot Water Supply: Each downfeed main for a hot water supply system shall be graded upward to the first branch connection, which shall be taken from the top of the main. Beyond the first connection the main shall grade downward, and all branch connections shall be taken from the bottom of the main. Connect a 1/2-inch circulating line to the bottom of each downfeed riser. Provide branch circuiting lines with gate valves in locations corresponding to the supply branch valve locations.

P. Grading: Hot water supply and hot water circulating lines shall be accurately and uniformly graded to avoid traps which might impede or destroy circulation. All lines shall be graded so as to facilitate drainage.

Q. Unions: Unions shall be installed near points of connection to each piece of equipment, and elsewhere as required for installation of piping, removal and replacement of regulating and control equipment and the like. Right and left couplings or nipples are prohibited.

R. Water Hammer Arresters: Water hammer arresters shall be provided where indicated on the drawings. Water hammer arresters shall be approved and installed in accordance with the requirements of PDI-WH201 and shall bear the PDI seal of approval.

S. Roughing: Roughing shall be provided for equipment furnished under other sections of the specifications. Where future extensions are indicated on the drawings, roughing shall extend to within the space to be served, and shall be valved, and capped or plugged.

END OF SECTION 220000

SECTION 22 0700

INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. It is the intent of this section of the specifications that all hot (above 105 deg. F.) and cold (below 55 deg. F) surfaces of all piping and mechanical system components be insulated, unless specifically excluded herein.

B. Systems to be insulated

1. Supply air ductwork
2. Culinary hot, hot re-circulating and cold-water piping systems
3. Hot water, hot re-circulating water, tempered water and waste lines below handicapped lavatories.
4. Refrigerant suction lines

C. The providing of all materials, supplies, equipment, tools, transportation, and facilities and performing all labor and service necessary to provide the work outlined above and as shown on the working drawings.

PART 2 – PRODUCTS

2.1 COMPLIANCE

A. All insulation shall (as a minimum) conform to the requirements of the building code and have a flame spread rating of less than 25 and smoke developed less than 50.

B. Insulation shall be as manufactured by Johns-Manville, Owens-Corning, Knauf, Armstrong, or Certainteed.

2.2 DOMESTIC HOT, HOT RE-CIRCULATING & COLD-WATER PIPING

All piping shall be insulated with 2-piece heavy density pipe insulation having an average thermal resistivity in the range of 4.0 to 4.6 Hr Deg. F. Ft2/BTU per inch of thickness on a flat surface at a mean temperature of 75 deg. F. Thickness of insulation shall be as follows:

MINIMUM PIPE INSULATION

INSULATION THICKNESS IN INCHES FOR PIPE SIZES**

PIPING SYSTEM TYPES	FLUID TEMP. RANGE, F	RUN-OUTS 2"*	1" & LESS	1-1/4" TO 2"	2-1/2" TO 4"	5" TO 6"	8" +
DOMESTIC HOT & HOT RECIRCULATING							
HS/HWR	120/200	1	1	1	1	2	2
DOMESTIC COLD-WATER SYSTEMS							
Cold, Water	40-55	1/2	1/2	3/4	1	1-1/2 To 2	2-1/2 & above
REFRIGERANT SYSTEMS							
Refrigerant Suction	Below 40	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2

* Runouts not exceeding 12 feet in length to individual terminal units.
** For piping exposed to outdoor air, increase thickness by 1/2".
Pipe insulation shall be covered with an all-service jacket.
* Insulated piping run exposed in occupied areas shall have a white PVC cover.

2.3 HOT WATER, TEMPERED WATER & WASTE PIPING EXPOSED BELOW PLUMBING FIXTURES

A. Insulate all exposed surfaces at all exposed lavatories and sink fixtures with an ADA style insulation kit as required by sink or lavatory manufacturer.

2.4 REFRIGERANT SUCTION PIPING

A. Refrigerant suction piping shall be insulated with 1-1/2" thick closed cell flexible foam. Insulation exposed to outside shall be finished with two heavy coats of U.V. resistant grey sealer.

PART 3 – EXECUTION

3.1 GENERAL

A. The contractor shall provide a complete installation which is neat in appearance and functional.

B. Remove all excess materials and packaging from job site.

C. All insulation shall be continuous thru wall and ceiling openings and thru sleeves.

D. Terminations of insulation on piping shall be tapered and coated with finish cement.

E. Insulation on all cold surfaces where vapor barrier jackets are used will be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.

F. Valves and fittings inside the building shall be insulated as specified for the piping systems and covered with high temperature P.V.C. insulation fitting covers.

G. Fittings and valves for pipe size smaller than 4" shall be insulated and finished with Insulating and Finishing Cement to a thickness equal to the adjoining pipe insulation. Vapor seal with a layer of glass fabric between two 1/16" coats of vapor seal adhesive. Lap seal outer jacket at least 1" on itself adjoining insulation.

H. In exposed areas, all fittings shall be additionally finished with FSK wrap smoothly adhered. Overlap the FSK wrap on itself and adjoining pipe insulation. Overlap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above. Piping exposed in occupied areas shall have a white PVC cover installed.

I. Insulation inserts and shields for cold surface piping such as domestic cold-water piping shall be installed at all pipe hangers. Inserts between the pipe and pipe hangers shall consist of calcium silicate block insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths, unless approved on submittals:

1/2" to 2-1/2" pipe size	6" long
3" to 6" pipe size	9" long

J. Rigid metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and length specified for the insulation hanger inserts.

K. Vapor barrier wrap shall be sealed tight and not penetrated by the hanger or shield.

L. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.

M. Where insulation pipes pass thru sound or fire-rated walls, floors, or ceilings, the insulation sleeves shall be sound or fire-rated to match rating of surface penetrated.

3.2 INSULATION WORKMANSHIP

A. All insulation shall be applied by specialists experienced in the field and shall be neat in appearance. Neatness in appearance shall be equated to proper insulation application procedures, and sloppy workmanship will not be tolerated. Work which is deemed unacceptable shall be condemned, removed, and replaced at the contractor's expense.

B. Protect floors, valve handle, accessories, etc., to keep paste off areas not being insulated.

C. Splitting of longitudinal sections on flexible foam pipe insulation will not be permitted.

D. Do not install insulation on pipes which require heat taping without coordinating with mechanical contractor.

3.3 CLEAN-UP

A. The piping shall be cleaned and tested prior to installation of insulation.

B. Fittings shall be cleaned after insulation is installed.

END OF SECTION 220700

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SECTION 23 0100

GENERAL PROVISIONS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The contractor shall carefully read the General Conditions of the Contract and all information to bidders which, with the following specifications for heating, cooling, plumbing, exhaust ventilation, and temperature control are a part of the Contract.

1.2 BASIC BID

A. Shall include all labor and materials specified in this division. The term "furnish" and/or "install" or similar implication shall mean "furnish and install complete."

1.3 SCOPE OF WORK

A. The work to be done under this section includes the furnishing of all labor, materials, equipment, controls and accessories required to complete all heating, air conditioning, ventilating, plumbing, drainage, and other mechanical systems as shown on plans and/or described in these specifications, including miscellaneous items required to provide a complete and functional facility.

B. Work shall include, but shall not be necessarily limited to, the following:

1. System commissioning
2. Testing
3. Balancing
4. Insulation systems
5. Exhaust systems
6. Automatic control systems
7. Air conditioning system
8. Plumbing systems
9. Special systems
10. Equipment start-up by factory trained and authorized technician

C. The mechanical contractor shall provide all miscellaneous electrical work and control wiring for special systems where the wiring requirements are provided by the equipment manufacturers and/or suppliers, unless all of the required wiring is clearly shown on the electrical drawings to be provided by the electrical contractor.

1.4 CODES AND ORDINANCES

A. All work shall be installed in accordance with the city, state, and local plumbing codes, and all other codes, ordinances, and regulations which govern the type of work covered by these specifications.

B. Should the drawings conflict with the code, the code shall govern the proper installation of the work, and no extra charge shall be made for such change.

C. Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Where the work required by the drawings and specifications exceeds the minimum code requirements, the work shall be done as shown or specified.

E. NOTE: Code compliance, or similar terminology, shall be interpreted to mean "the interpretation of the code as enforced by the local building authority".

1.5 DRAWINGS AND SPECIFICATIONS

A. These specifications are intended to cover all labor, material, and standards of mechanical workmanship to be employed in the work shown on the drawings, called for in these specifications, or reasonably implied by terms of same. The drawings and specifications are intended to supplement one another, and any part of the work that may be mentioned in the one and not represented in the other shall be done the same as if it had been mentioned or represented in both.

B. Large scale drawings shall take precedence over layouts and small-scale details.

C. The mechanical drawings are schematic in nature, and show the general arrangement of all piping, ductwork, mechanical equipment, and appurtenances. They shall be followed as closely as the actual building construction and the work of other trades will permit.

D. Due to tight structural conditions and space limitations in selected areas the contractor should anticipate structural and space conflicts and shall make allowances for them in his bid. Until the steel fabrication shop drawings are submitted for review, the mechanical coordination cannot be completed.

E. The architectural and structural drawings shall be considered part of the mechanical work insofar as these drawings furnish this Division with information relating to design and construction of the building. Architectural and structural drawings take precedence over the general building layouts and details shown on the mechanical drawings.

F. The structural engineer and architect shall approve all attachments to or modifications of any structural members in the building required for installation of the mechanical systems.

G. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which will actually be required. This contractor shall investigate the structural and finish conditions affecting the work and provide all necessary offsets, fittings, valves, trim, and accessories required to meet actual on-site conditions.

1. Dimensions -

    a. Verify dimensions governing mechanical work at the building. No extra compensation shall be claimed or allowed on account of differences between the actual job-site dimensions and those indicated on the drawings.

2. Adjoining work -

    a. Examine all adjoining work on which the mechanical work is dependent and report any work which must be corrected. No waiver of responsibility shall be claimed or allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 INTERPRETATION OF DRAWINGS AND DOCUMENTS

A. If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the drawings or specifications, he may submit to the Owner's representative, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the proposed documents will be made only by addenda duly issued, and a copy of such addenda will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of the proposed documents. All questions shall be submitted at least seven days in advance of bidding.

B. The Owner's representative will interpret the meaning of any part of the drawings and specifications about which any misunderstanding may arise, and his decisions will be final. Should there appear to be any error or discrepancy in or between the drawings and specifications, the contractor shall refer the matter to the Owner's representative for adjustment before proceeding with the work. Should the contractor proceed with the work without so referring the matter, he does so on his own responsibility.

1.7 WORKMANSHIP

A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative.

1.8 SUBSTITUTIONS

A. Special Conditions pertaining to Substitutions.

1.9 FEES & PERMITS

A. This contractor shall obtain all necessary permits. Tooele County School District shall pay all fees required in connection with the work.

B. Requirements of the local utility companies shall apply at the time of bidding. Contractor shall have checked with the local utility companies, and shall determine from them all valves, boxes, meter boxes, and meters which they will require to be installed, and shall figure cost of same in his bid.

1.10 SITE INSPECTION AND EXAMINATION OF DRAWINGS

A. The contractor shall carefully study all drawings and specifications pertaining to the work. If any of the work as laid out, indicated, or specified is contrary to or conflicts with any governing ordinances or regulations, the same shall be reported to the Owner's representative before submitting a bid. The Owner's representative will then issue instructions as to procedure.

B. The contractor shall carefully examine the building site and compare the drawings with existing conditions. By the act of submitting a bid, the contractor shall be deemed to have made such examination, to have accepted such conditions, and to have made allowance therefore in preparing his bid.

1.11 VERIFICATION OF DIMENSIONS

A. Before proceeding with any work, the contractor shall carefully check and verify all dimensions, sizes, etc., and shall assume full responsibility for the rigging and fitting-in of his ductwork, piping, and equipment. Where apparatus and equipment has been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The contractor shall carefully check the drawings to see that the equipment he is required to install will fit into the spaces provided and will allow for proper maintenance and service of the equipment.

1.12 COORDINATION

A. This contractor shall coordinate his work with other specification divisions and shall provide all necessary specialty items, trim, and incidental 115 volt and 24-volt power and control wiring (which is not shown or specified under other divisions) required to provide a complete functional acceptable system.

B. The Division 23 contractor shall coordinate his work such that all slots and openings through floors, walls, ceilings, and roofs are properly located and shall do any cutting and patching caused by neglecting to do so.

1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into the construction as the work proceeds.
2. It is the responsibility of Division 23 to locate these items and see that they are properly installed.

C. The locations of all piping, ducts, apparatus, and equipment indicated on the drawings are approximate only, and shall be changed as required to meet the actual architectural and structural conditions at the job site. All changes shall be approved by the Owner's representative. Any change in work which has not been installed shall be made by the contractor without additional compensation, except changes which are caused by architectural and structural changes which substantially increase the size of any of the mains, or which substantially increase the number of fixtures or length of pipe runs. Any and all changes shall be made only upon approval of a written change order.

1. Right of way - Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.
2. Offsets, transitions, and changes in direction in pipes and ducts shall be made as required to avoid conflicts with building footings and foundations or other buried ducts or utilities, and to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, and devices as required to affect these offsets, transitions and changes in direction.

D. It shall be each contractor's responsibility to verify exact location, elevation, and/or route of the various mechanical system components with architectural details and with Owner's representative's personnel on job.

E. Where deviations from locations and/or arrangements described are necessary to meet actual job conditions, the changes shall be made without cost to the Owner.

F. The Owner's representative reserves the right to make any reasonable change in location of any outlet, piping, or equipment, before installation, without additional cost.

1.13 LOCATION OF CEILING OUTLETS

A. This contractor shall assist the Owner's representative, General Contractor, Electrical Contractor and other interested parties in the establishment of room centerlines, axis of rooms and all walls.

B. All grilles, registers, ceiling diffusers, etc. shall be located with reference to these established data points.

C. These outlets shall be referenced to such features as room centerlines, walls and ceiling furrings, balanced border widths, etc.

D. Outlets in acoustical tiles, panels, etc. shall occur in joints or centers of whole pieces, etc.

E. The final determination of the exact location of all outlets shall be subject to the direction and approval of the Owner's representative.

1.14 PROVISIONS FOR REMOVAL & ADEQUATE CLEARANCE

A. Install Mechanical work to permit removal of heating and cooling coils, filters, belt guards, sheaves, drives, and other parts requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.

B. Arrange pipes, ducts, and equipment to permit ready access to filters, valves, cocks, traps, starters, motors, control components, and to clear the openings of swinging doors and access panels.

1.15 RECORD DRAWINGS

A. The contractor shall maintain one set of record drawings. These prints shall show the location, elevations and details of all items of work installed under this contract. Buried piping shall be located by dimensions from foundation walls and depths of bury shall be indicated. These shall be marked in red. The completed set of record drawings must be submitted to the Owner's representative before the contractor is eligible to receive the final payment. An up-to-date record set of drawings shall be maintained during the progress of the project and be available to the Owner's representative upon request.

1.16 COORDINATION DRAWINGS

A. The contractor shall provide coordination drawings, when requested by the Owner's representative, to ensure that the various mechanical system components are coordinated with each other, and with other building systems.

B. The coordination drawings shall be drawn to scale (usually 1/4" = 1'-0") and shall show all systems as they relate to each other, especially in areas of potential conflict.

C. Equipment room coordination drawings shall include, in addition to the information specified, the size and location of all piping, pipe fittings, valves, strainers, specialties, flexible connections, water treatment devices, control panels, etc., and their installed elevation.

D. Equipment room coordination drawings shall show the location of all pertinent electrical outlets, lights, panels, transformers and switch gear, and their required clearances from duct, piping, and equipment, and for maintenance access.

E. Footing and foundation coordination drawings shall be prepared showing the exact location, depth, and slope of all buried piping to be installed. These coordination drawings shall include all sand and grease interceptors, drains in depressed slab areas, and all necessary buried water piping.

F. This set of foundation coordination drawings shall be maintained in the construction trailer and shall be marked up daily to indicate exact location and elevation of all buried piping and conduit systems.

G. Coordination drawings shall be professionally drafted and shall be clear and concise in their presentation and clarity.

H. All coordination drawings shall be prepared in digital format of latest version of Revit. Material shall be submitted in both printed and disk form.

I. All ductwork and piping attachments to the building structure shall be detailed and shall be coordinated with the Owner's representative.

1.17 COOPERATION WITH OTHERS

A. The contractor shall so organize the work that progress will harmonize with the work of all trades, so that all work may proceed as expeditiously as possible. The contractor shall be held responsible for any delays which might be caused by his negligence or failure to cooperate with other contractors or crafts.

1.18 FOREMAN

A. A full-time foreman shall be designated by the contractor to the Owner's representative and shall be available on site for consultation. This individual, when appointed, will not be replaced without prior approval from the Owner's representative. The foreman shall be responsible for the coordination and correct placing of the work.

1.19 GUARANTEE

A. By the acceptance of the contract award for the work herein described, the contractor assumes the full responsibility imposed by the guarantee as set forth herein and should protect himself through proper guarantee from equipment and specialty manufacturers and subcontractors as their interests may appear.

B. All materials and equipment provided and installed under this division of the specifications shall be guaranteed for a period of one (1) year from the date of substantial completion and acceptance by the Owner, unless specifically noted elsewhere in the specification. Should any trouble develop during this period due to defective materials or workmanship, the contractor agrees to correct the trouble without any cost to the Owner, any defect noticed at the time of installation and/or during the guarantee period shall be corrected immediately to the satisfaction of the Owner.

1.20 SCHEDULES, MATERIALS AND EQUIPMENT

A. Approved Manufacturers:

1. Naming of a manufacturer or product does not mean the manufacturer or product automatically complies with the design documents. Submittals must meet all design criteria and shall be acceptable in all respects to the project design team.

B. As soon as practicable, and within 30 days after date of award of contract, and before commencement of work, a complete schedule of equipment and materials proposed for installation shall be submitted to the Owner's representative. The schedule shall include catalogs, cuts, drawings, and such other descriptive data or samples that are requested by the Owner's representative. Schedules shall include all items of equipment used. No partial submittals will be accepted.

C. Provide complete digital copies of each required shop drawing or similar submittal to the Owner's representative for review, approval. DO NOT SUBMIT without general contractor's signed stamp, indicating the general contractor has reviewed the submittal for completeness and conformance to the Contract Documents.

D. Inform the Owner's representative by notation, or in the letter of transmittal, of any proposed deviation from the requirements of the Contract Documents.

E. Provide required shop drawings or other submittals within time stipulated on approved progress schedule.

F. Do not commence work requiring a shop drawing or other submittal until approval of the required submittal has been received. Such approval will be based upon a review only for conformance with the design concept of the project and with the information given in the Contract Documents and does not relieve the contractor from responsibility for errors or omissions in the shop drawings.

G. Schedules shall be completely indexed by Division, and shall include the following items:

1. Circulators
2. Valves
3. Water heaters
4. Piping systems
5. Pipe supports & restraints
6. Unit heaters
7. Pressure gauges & thermometers
8. Plumbing fixtures
9. Exhaust air fans
10. Dampers
11. Insulation systems
12. PRV stations
13. Insulation systems
14. Seismic restraints
15. Automatic temperature controls
16. Air balance contractor qualifications
17. Fire safing system with installation diagrams
18. Other schedule items

H. Submittals received which do not contain all of the above items will be returned unchecked.

I. Purpose and Contractor's Responsibility

1. The purpose of the final submittal is to "assist the contractor selecting the equipment." The contractor shall review the submittals prior to submission to the Owner's representative to make sure that the submittals are complete in all details including the following items:

a. Manufacturers' names shall be mentioned in specifications as accepted by Owner at time of bidding.
b. Equipment dimensions shall be verified to fit the spaces provided with sufficient clearances, as may be required by the equipment or indicated on the drawings.
c. Equipment shall be reviewed with respect to schedules, specifications, plans and details.
d. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.

J. Review

1. Review and acceptance of submittal does not relieve the contractor of his responsibility to fulfill the contract requirements. Review and acceptance of the submittal will not be used as a means of changing the contract requirements. Items not covered in the accepted submittal, or items incorrectly covered but not recognized or identified, shall not be used when contrary to the requirements of the contract documents.

K. Acceptance of Substitute Equipment

1. If the proposed installation is approved, this contractor shall make all incidental changes in piping, ductwork, supports, installation, wiring, heaters, panel boards, and as otherwise necessary. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for the proper operation of the system resulting from the contractor's selection of alternate equipment, including all required changes in the effected trades.

L. Owner's Refusal Right

1. In the event that items submitted are substitutions for specified items and are found to be not acceptable, the right shall be reserved to require the specified items.

1.21 OPERATING INSTRUCTIONS AND CATALOG INFORMATION

A. This contractor shall compile in digital format of every product used by him in the completion of the work. The digital submittal shall also include copies of the test data (Section 230593), balancing reports (Section 230593), and system commissioning data (Section 230800). Before final acceptance by the Owner's representative, he shall turn over to the Owner this compilation of catalog data. A double index shall be provided, one giving an alphabetical list of products for which catalogs are included, and one giving their addresses, whose products are included in the work. Provide data for each item of equipment listed in SCHEDULES, MATERIALS & EQUIPMENT, as shown in Section 230100. A copy of submittal data shall be delivered to the Owner's representative for his approval.

B. Provide warranty schedule and schedule of overload protection as required in Section 230800.

C. Project shall be identified as follows:

TCSD WAREHOUSE 649 REMODEL
TOOELE COUNTY SCHOOL DISTRICT
OPERATING & MAINTENANCE MANUAL
2022
SET #

PART 2 – PRODUCTS

2.1 MATERIALS, EQUIPMENT, AND ACCESSORIES

A. Unless otherwise specified, all equipment, accessories, and materials shall be new and undamaged, and the workmanship shall be of the best quality for the use intended and shall be acceptable to the Owner's Representative.

B. Equipment, accessories, and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.

C. Should mechanical equipment other than that used in the design be furnished, it shall be the responsibility of the mechanical subcontractor to provide large scale (1/2" = 1'-0") installation drawings, as required, showing service and maintenance points with proper clearance allowances for service.

D. All equipment shall be selected to deliver full rated capacity at the job site elevation.

PART 3 – EXECUTION

3.1 FUNCTIONING AND OPERATION OF EQUIPMENT

A. Contractor's Responsibility:

1. Installation and startup shall be so made that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order.

B. All Division 220000 & 233000 equipment shall be started by a factory trained and authorized technician. Start up for all equipment shall be witnessed by owner and commissioning agent.

3.2 CLEANING AND PATCHING BY MECHANICAL CONTRACTOR

A. The contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.

3.3 INSTRUCTIONS TO OWNER'S REPRESENTATIVES

A. The mechanical contractor shall provide, without expense to the Owner, competent instructors to train the Owner's representatives in the care, adjustment, maintenance, and operation of all parts on the heating, air conditioning, ventilating, plumbing, and automatic temperature control systems and equipment.

B. At the time of training, the contractor shall demonstrate to the building owner that all equipment and systems are functioning as designed. Contractor shall also demonstrate to the owner all sequences, interlocks, and alarms related to the building system.

C. Instruction date shall be scheduled at the time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Owner's representative.

3.4 PROTECTION AGAINST THE ELEMENTS

A. The contractor shall, at all times, take reasonable and adequate precautions to protect his work and all stored materials and equipment from damage by the elements, including flooding, windstorms, etc., and shall not expose the work of any other contractor to such damage.

B. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by the Owner's representative until installed.

C. All items subject to moisture damage, such as controls, shall be stored in dry, heated spaces.

D. Protect all bearings during installation, and thoroughly grease steel shafts to prevent corrosion.

3.5 REMOVAL OF DEBRIS, ETC.

A. Upon completion of this division of the work, remove all surplus material and rubbish resulting from the work, and leave the premises in a clean and orderly condition.

3.6 OPENINGS FOR MECHANICAL SYSTEMS

A. All openings required for installation of mechanical systems shall be provided by the mechanical contractor. Any piece of equipment which is to be installed in any space of the building and which is too large to permit access through stairways, doorways or shafts shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed. Materials shall be delivered at such stages of the work as will expedite the work as a whole.

3.7 SAFETY REGULATION

A. The contractor shall comply with all local and OSHA safety requirements in performance with this work. (See General Conditions). This contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

3.8 OWNER FURNISHED EQUIPMENT

A. This contractor shall include in his bid the necessary labor and material to properly coordinate and install the required piping, trim, specialties, controls, ductwork, and other necessary utilities and services to equipment furnished by the Owner.

B. This contractor shall relocate (where noted), rough-in and make final connections to owner furnished equipment.

C. See bid documents for a list of owners furnished equipment which is not otherwise identified on the mechanical drawings or in the mechanical division of the specifications.

END OF SECTION 230100

SECTION 23 0593

TESTING/BALANCING

PART 1 – TESTING GENERAL

1.1 DESCRIPTION

A. The work outlined in this section shall be performed by the several trades involved.

B. The mechanical contractor shall provide all supervision, labor, materials, tools, scaffolding, and equipment required to complete all system testing.

C. The mechanical contractor shall remove and repair any defective component as indicated by the system tests and retest.

D. The mechanical contractor shall test the operation of all safety and high limit controls to insure proper installation and operation. Any defective devices shall be replaced.

1.2 TESTS AND ADJUSTMENTS

A. Before any piping is covered, tests shall be made in the presence of the Owner's Representative, and any leaks or defective work corrected. No caulking of threaded work will be permitted.

B. Before application of insulation covering, and as far as practical before concealing any piping, all piping shall be hydrostatically tested and proved tight.

C. Stubs shall be capped, and all control valves shall be removed during the test.

D. System may be tested in sections, providing connections to last section tested are included in each succeeding test.

E. Following minimum pressures shall be used for testing:

1. Domestic hot, hot re-circulating, and cold-water piping at 150 psig for six hours.
2. Plumbing waste and vent piping at 10 ft. head for 30 minutes.

F. All valves and equipment which may be damaged shall not be subjected to the test pressure.

PART 2 – PRODUCTS

2.1 MATERIALS EQUIPMENT & ACCESSORIES

A. The contractor shall furnish all necessary gauges, plugs, test fans, pumps, etc., as required to conduct the tests.

2.2 REPORTS

A. The contractor shall give the Owner's Representative one week notice prior to performing the tests. All tests shall be recorded, and copies of reports bound in the O & M manual and CD ROM and given to the Owner.

PART 3 – EXECUTION

3.1 PROCEDURE

A. The contractor shall be responsible to conduct all tests in a safe manner, protecting the work of other trades from water or physical damage.

B. The tests, as indicated, shall be in addition to any test, as required, by any governing agency. Submit all approved tests, as required, by any governing agency to the Owner's representative.

C. Each test and any necessary repairs and retest shall be performed by the contractor which installed the system.

D. Upon completion, a test shall demonstrate that the culinary hot water system is circulating, that all traps are properly vented, that there is an ample supply of hot and cold water to fixtures, that no fixture or equipment can be back-siphoned, and that there are no back-flow connections.

PART 4 – BALANCING GENERAL

4.1 SCOPE OF WORK

A. The mechanical contractor shall employ an independent technical firm to perform the checking, adjusting, and balancing (CAB) of the HVAC systems. This firm shall be one whose operations are limited to the field of professional CAB, and this firm shall meet the following qualifications:

1. The firm shall be a member of AABC and/or NEBB.
2. The firm shall be one which is organized to provide professional services of this specific type.
3. The firm shall have completed projects of similar scope within the past 12 months and shall be capable of performing the services specified at the location of the facility described within the time frame specified and following up the basic work as may be required.
4. All personnel used on the job site shall be engineering technicians, who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to the start of the work for this project.
5. Suggested contractors shall be Certified Test & Balance, RS Analysis, Independent Test & Balance, Bonneville Test & Balance and BTC Services.

B. As a part of this contract, the mechanical contractor shall make all changes in the sheaves, belts, and dampers, including the addition of dampers required for correct balance as required by the CAB firm, at no additional cost to the Owner.

C. The mechanical contractor shall provide, and coordinate services of qualified, responsible subcontractors, suppliers, and personnel as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting, and balancing period.

D. In order that all systems may be properly checked, balanced, and adjusted as required by these specifications, the mechanical contractor shall operate said systems at his expense for the length of the time necessary to properly verify their completion and readiness for the CAB and shall further pay all costs of operation during the CAB period.

E. The project completion schedule shall be coordinated with the CAB work to provide sufficient times to permit the completion of CAB services prior to Owner occupancy.

4.2 DOCUMENTS

A. The Owner's representative will furnish, without charge to the CAB firm, one set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of plans less the structural sheets.
2. One set of mechanical floor plans of the conditioned spaces.

B. These sheets should be ozalid type (blue or black on light background) reproductions to facilitate marking.

C. Approved submittal data on equipment installed to accomplish the test procedures outlined in paragraph "Services of the CAB Firm" of this specification will be provided by the mechanical contractor.

D. The Owner's representative will transmit one copy of the following "Records for Owner" to the CAB firm for review and comments:

1. Record drawings
2. Approved fixture brochures, wiring diagrams, and control diagrams.
3. Shop drawings
4. Instructions
5. Motor and valve charts
6. Operating and Maintenance Manuals

4.3 SERVICES OF MECHANICAL CONTRACTOR

A. The mechanical contractor shall have all systems complete, calibrated, and in operational readiness prior to notifying the CAB firm that the project is ready for their services. The mechanical contractor shall coordinate system readiness with the system commissioning contractor and shall certify in writing to the Owner's representative that the system is complete and ready to balance.

4.4 SERVICES OF THE CAB FIRM

A. The technical CAB firm shall submit biographical data on the individual proposed to directly supervise the CAB work. It shall also submit their record of specialized experience in the field of air and hydronic system balancing.

B. Act as liaison between the Owner's representative and contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses. The inspection will cover only those parts of the systems relating to the checking and balancing.

C. To check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building.

D. Prepare and submit to the Owner's representative, complete reports on the balance and operations of the systems.

E. The CAB firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of the following general systems, including all components.

1. Freon compressor systems, including, controls, etc.
2. Temperature control system in its entirety, includes the verification of all control sequences and safety devices.
3. Exhaust systems.
4. Domestic water re-circulating systems.

F. Before any adjustments are made, the air systems are to be checked for such items as dirty filter, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc.

G. Before any adjustments are made to water systems, the strainers shall be cleaned, temperature control valve operation shall be checked, pump rotation shall be checked, pressure reducing valves shall be adjusted, etc.

H. It shall be the responsibility of the CAB personnel to check, adjust, and balance the components of the various systems as listed above using an applicable "proportionate balance procedure" in order that each of them will operate under optimum noise, temperature and air flow conditions in the conditioned spaces in the building "while simultaneously operating at the most energy efficient condition."

I. During the balancing process, if abnormalities or malfunctions of equipment or components are discovered by the CAB personnel, the owner's representative shall be advised promptly so that the condition may be corrected by the project contractor. Data from malfunctioning equipment or components shall not be recorded in the final CAB report.

PART 5 – PRODUCTS

5.1 EQUIPMENT AND INSTRUMENTS

A. This contractor shall provide all necessary labor, equipment, scaffolding, instruments, and materials required to adjust, balance, and check all systems.

PART 6 – EXECUTION

6.1 REPORT

A. The activities, as described hereinbefore, will culminate in a report to be provided to the Owner's representative. This report shall be furnished in O & M manual and CD ROM. One copy shall be bound in O & M manual. The intent of the final report is to provide a reference of actual operating conditions for the building operating personnel.

B. The CAB report shall include the following as a minimum:

1. Preface

a. A general discussion of the systems, any idiosyncrasies, any problems encountered, an outline of normal sequence of operation for the HVAC system cycles, any un-corrected noise problem.

2. Pitot Tube Traverses

    a. For use in future trouble-shooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.

3. Temperature Tabulation

    a. Of all conditioned spaces on a room-by-room basis, a total of at least three readings will be taken of each room on successive days. Record outside ambient temperature at two-hour intervals. The total variation in conditioned space temperatures shall not exceed 2 deg. variance from the thermostat settings.

4. Air Volumes and Velocities

    a. As measured at each supply grille, return air grille, and exhaust air grille or air handling device. In all fan systems, the air quantities indicated on the plans may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the contractor to furnish or revise fan drive and/or motors, if necessary, without cost to the Owner, to attain the specified air volumes.

5. Air Pressure

    a. As measured across each supply fan, cooling coil, heating coil, air handling unit filter and exhaust fan. Relate these readings to the particular fan curve in terms of CFM handled at the various static pressures, and their relationship to fan power and fan instability.

6. Electrical Current/Voltage

    a. Measurements to be taken at the drive motor on each piece of equipment.

7. Fan Speeds

    a. To be measured in RPM.

8. Instrumentation List

    a. A list of instruments by type and make used in gathering the CAB data.

9. Drawings

    a. The CAB contractor's working drawings shall have the supply air and exhaust air openings numbered and/or lettered to correspond to the numbers and letters used on the report data sheets so that data in the report can be correlated with each specific supply air opening in the building. If room numbers actually used in the building differ from those on the plans, the building room numbers shall be marked on these plans. Only one such marked-up set of drawings need be provided with the six copies of the CAB report.

C. Before final acceptance of the CAB report, the report data, at the discretion of the Owner's representative, shall be verified one time on the job site, by selection of check points (not to exceed 10 percent of total) at random, in the presence of the Owner's representative. Representatives of the testing firm doing the work shall be present and provide the necessary equipment for test data verification.

D. The firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, all dampers in the duct system, all air distribution devices, the flows of freon or water thru all coils, and the power consumption of all motors.

E. During the CAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. The Owner's representative will be advised of any instruments out of calibration so that the controls subcontractor may come in and recalibrate, using data supplied by the balancing firm.

F. Make a total of two inspections within ninety (90) days after occupancy of the building to insure that satisfactory conditions are being maintained throughout and to satisfy and unusual conditions.

G. An additional inspection in the building shall be made by the firm during the season opposite that in which the initial adjustments were made. At that time, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space.

H. At the time of opposite season checkout, the Owner's representative shall be given timely notification before any readings or adjustments are made so that they may participate in the checkout.

END OF SECTION 230593

SECTION 23 0800

SYSTEM COMMISSIONING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work required under this section shall include, but not necessarily be limited to, the following:

B. The pre-startup inspection of all systems by a **Qualified Independent System Commissioning Contractor** and coordinating of the subsequent correction of any incorrect items.

C. Repair, replacement, or adjustment of each item shall be performed by the installing contractor.

D. System operations inspection.

E. Contractor shall be required to provide a detailed commissioning report verifying proper operation of all equipment and devices, correct control sequences for all systems and proper air and water flow for systems throughout the building.

F. The independent system commissioning contractor shall act as liaison between the Owner's representative and contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses. The inspection will cover only those parts of the systems relating to system commissioning.

G. The intent of this section is to provide for proper installation, startup, service, and operation of the mechanical systems in preparation for system balancing. See Section 230593 for balancing.

1.2 PRE-STARTUP INSPECTION

A. The pre-startup inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.

B. All pertinent items shall be checked, including, but not necessarily limited to, the following:

1. Removal of shipping stops.
2. Vibration isolators and seismic snubbers properly aligned and adjusted.
3. Flexible connections are properly aligned.
4. Belts are properly adjusted.
5. Belt guards and safety shields are in place.
6. Safety controls, safety valves, and high or low limits are properly installed and functioning.
7. All systems are properly filled.
8. Filters are in place with a proper seal around their edges.
9. Fire dampers are properly installed, linked, and serviceable.
10. Pressure and temperature gauges of the proper size and range are installed.
11. All test stations and measuring devices are properly installed and functioning.
12. Initial lubrication of equipment is complete.
13. Filters and strainers are clean.
14. Motor rotations are correct.
15. Voltages match nameplates.
16. Control system is operating properly.
17. All interlocks are wired and verified.

18. All controls have been connected and verified.
19. All valves, dampers, and operators are properly installed and operating.
20. All ductwork is installed and connected.
21. All roof-mounted equipment is properly flashed.
22. All water piping is either heat taped or located in spaces which are heated to prevent freezing.
23. Piping which is run above the roof or is otherwise subjected to freezing is properly heat taped and insulated.
24. All other items necessary to provide for proper start-up.
25. All seismic restraints are in place and secured.
26. All condensate drain lines are piped to discharge in proper drains.

1.3 FIRST RUN INSPECTION

A. Recheck all items outlined in pre-startup inspection to insure proper operation.

B. Check the following items:

1. Excessive vibration or noise.
2. Loose components.
3. Initial control settings.
4. Motor amperages.
5. Heat buildup in motors, bearings, etc.
6. Control systems are sequencing properly, calibrated and functioning as required.
7. Heat tapes are wired & functioning.

C. Correct all items which are not operating properly.

1.4 SYSTEM OPERATION INSPECTION

A. The mechanical systems shall be observed by the owner under operation conditions for sufficient time to insure proper operation under varying conditions, such as daylight and heating-cooling.

B. Periodically check the following items:

1. Strainers and filters.
2. Visual check of air flow for "best guess" setting for preparation for system air balancing under Section 230593.
3. Control operation of time clocks, on-off sequences, system cycling, etc.
4. Visual checks for water flow, seals, packings, safety valves, operating
5. Cleaning of excessive oil or grease.
6. Dampers close tightly.
7. Valves close tightly.
8. System leaks.
9. All other items pertaining to the proper operation of the mechanical system, whether specifically listed or not.

1.5 WARRANTY SCHEDULE

A. Provide a list in each O & M Manual of all motors, fans, and equipment with manufacturer's names, models, serial numbers and date of startup approved by the Owner's representative, date of warranty, extent of warranty, and equipment supplier with address and phone numbers.

1.6 SCHEDULE OF OVERLOAD PROTECTION

A. Provide a list in each O & M Manual of all motors with size, voltage, amperage, and size and rating of overload protection.

1.7 REPORT

A. Prior to the start of system balancing the system commissioning sub-contractor is required to submit a detailed written report to the owner's representative outlining the results of the system commissioning work for each system and piece of equipment which lists any un-corrected system abnormalities.

1.8 CERTIFICATION

A. Provide written certification of all tests, and start-up procedures. Bind a copy of this certification in the O & M manuals. Certification shall include an itemized list of systems serviced during the system commissioning process with dates, times, and a complete description of the work completed, and the name of the responsible system commissioning mechanic.

END OF SECTION 230800

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SECTION 230900

BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the basic materials and methods to be used in Division 21, 22 & 23 work.

1.2 MATERIALS & EQUIPMENT

A. All materials shall be new and undamaged. Protect all stored materials and equipment from damage by the elements, including exposure to excessive heat, flooding and rain, windstorms, etc.

B. All materials and equipment shall be installed in strict compliance with the manufacturer's recommendations.

1.3 CUTTING AND PATCHING

A. Any cutting, patching, or filling necessary for the proper execution of this work, except as noted on drawings, shall be done by this contractor.

B. No rough or unsightly work will be allowed. Cutting of structural members shall be done only on approval of the Owner's representative.

C. The attention of the contractor is directed to the requirements of running pipes thru concrete slabs, walls, and beams. These conditions are to be anticipated and sleeves installed as provided for under "Sleeves".

1.4 INSERTS

A. Furnish and set, in all necessary locations, before or during construction, unistrut inserts for use in connection with the support and seismic restraint of piping, ductwork, and equipment furnished under this division of the work.

1.5 SLEEVES

A. Sleeves for Concrete or Masonry Surfaces

1. For pipes passing thru masonry or concrete construction, provide sleeves at least two pipe sizes larger than the pipe passing thru and made from sections of steel pipe.
2. Provide galvanized iron sleeves with collar on each side of wall for all ducts passing thru masonry or concrete construction.
3. Sleeves shall be placed in structural members only where approved by the Owner's representative.
4. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

B. Sleeves thru Finished Surfaces

1. For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

C. Sleeves thru Fire-rated Surfaces

1. All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes and/or ducts have been placed with a U.L. listed fire safing system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.

D. Sleeves thru Sound Rated Surfaces

1. Pipe or duct sleeves thru sound rated walls or surfaces shall be packed with dense fiberglass. Duct sleeves shall be sealed with duct sealer and fitted with metal cover flanges on both sides.

E. Sleeves thru Floors

1. Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

1.6 PIPE LOCATION AND ARRANGEMENT

A. No water supply piping inside the building shall be placed in direct contact with the earth. Buried water piping shall be placed in split tile or PVC pipe to keep pipe from direct contact with ground.

B. Unless otherwise noted on the drawings, all water piping shall be kept out of concrete floor slabs.

C. Under no circumstances shall plastic piping or ducting materials be run inside of supply or return air plenums.

D. All piping shall be properly racked and supported to run straight and true.

E. All changes in direction shall be made with approved fittings. Pipes shall not be bent to change direction.

F. All piping shall be racked and run to facilitate maintenance work. Under no circumstances shall valves, shock absorbers, drip traps, or piping specialties be installed in a "closed space" without proper access provided for future maintenance. See "Access Doors" section of specifications.

G. NOTE: All piping shall be capped or plugged at the end of each work shift and when not being extended, to prevent the entry of rocks and debris.

H. Any timelines are broken or disconnected, they shall be capped immediately after flushing to remove rock and debris from pipes. **If rocks or other foreign materials are found in the system after it has been closed, the contractor shall stand the expense of their removal.**

I. All valves, piping, and equipment to be installed so as to permit disassembly for maintenance purposes.

J. Provide drain valves at all low points in piping systems. Run to floor drain where possible, otherwise provide 3/4" hose connection with vacuum breaker.

1.7 VERIFICATION OF INSTALLATION

A. At time of final inspection contractor shall provide a color CD of all new buried sanitary sewer and storm sewer and all new buried sanitary sewer lines running to 5'-0" outside of building line.

B. Video must be taken after installation is complete to ensure that line is installed Properly with no low spots, separations, etc. Video shall be performed with water in lines. All areas shall be identified and running linear feet shall be noted. Video shall also ensure that all connections have been made properly and that no debris remains in piping system. At any point that debris is noted, debris shall be removed by the contractor and line video re-done for that portion of the line. Building owner shall be notified to witness videotaping.

C. Piping video shall be performed by a source approved by Owner and project engineer.

1.8 PIPE JOINING

A. All steel pipe under 2" in size shall be joined by screwed connections.

B. All joining shall be made to maintain the full metal strength of the pipe, with neat and workmanlike appearance.

C. All piping must be perfectly clean before the system is filled.

D. Copper Piping in Domestic Water Service: Piping shall be cut (with a pipe cutter) so ends are square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall be guided with a miter box to insure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.

E. The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished with fine crocus cloth or fittings brushes until all dirt and oxide is removed.

F. A light coat of soldering flux shall be applied to both pipe and fittings. **Acid flux shall not be used.**

G. Joints in copper pipe shall be uniformly heated to proper soldering temperature to ensure that solder will flow to **all parts** of the joint. The solder shall be fed to the joint until a uniform line of solder appears around the pipe at the end of the fittings.

H. Copper piping used in domestic water service shall be joined with 'Stay-Safe-50' or 'Silvabrite-100' no lead solder.

I. When valves are being installed in copper piping, the non-metallic parts shall be removed to prevent the heat of soldering from damaging the valves. No heat shall be applied near where an excessive temperature may cause damage.

J. PVC pipe joining: Debur and chamfer the end of the pipe removing any ridges or rough edges. If the end is not chamfered, the edge of the pipe may remove the cement from the fitting socket and result in a leaking joint.

1. Clean and dry the surfaces to be joined.
2. Test fit the joint and mark the depth of the fitting on the outside of the pipe.
3. Uniformly apply a liberal coat of primer to inside socket surface of the fitting and the male end of the pipe to the depth of the fitting socket.
4. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement shall be applied lightly, but uniformly to inside of socket, take care to keep excess cement out of socket. Apply a second coat to the end of the pipe.
5. Immediately after applying the last coat of cement to the pipe, and while both inside socket surface and the end of the pipe are wet with cement, forcefully insert the end of the pipe into the socket until it bottoms out. Turn the pipe 1/4 turn during assembly (but not after the pipe is fully inserted) to distribute the cement evenly.
6. Assembly should be completed within 20 seconds after the last application of cement. Hammer blows should not be used when inserting pipe.
7. After assembly, wipe excess cement from the pipe at the end of the fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate a defective assembly due to insufficient solvent.
8. Handle joints carefully until completely set.
9. Suspend piping a minimum of every four feet using location hangers.

1.9 SCREWED CONNECTIONS

A. All pipe shall be reamed at the ends and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-l/8 the length of the female thread receiving the pipe. The pipe shall be screwed in the full length of the female thread.

B. Pipe shall be made tight with teflon thread tape or thread lubricant worked into male thread only. Surplus material shall be wiped off and the joint left neat and clean. Lubricant shall be powdered graphite and linseed oil, or plumbage and linseed oil.

1.10 PIPE GRADING

A. Piping shall be uniformly graded in direction of flow as noted below:

PIPING	FALL/RISE	DIRECTION	PER/RUN
Water	1"	Up	40'
Waste - 4" & smaller	1"	Down	4'
Vent	1”	Up	4’
Natural Gas	1”	Down	40’
Refrigerant	1”	Down	40’

1.11 EQUIPMENT BASES

A. Water heaters, tanks and other equipment shown on the plans shall be set on 4" high concrete pads. The pads shall be furnished by General Contractor. The mechanical contractor shall coordinate pad size and location with the general contractor.

1.12 VIBRATION ISOLATION

A. All mechanical equipment over 5 H.P. shall be isolated in accordance with Table 34, Chapter 42, in the 2012 ASHRAE Handbook.

B. Care shall be taken by this contractor to prevent the transmission of vibration from equipment to building structure. Flexible connectors shall be installed in all piping connecting to pumps, air handling units, cooling towers, and other flexibly mounted equipment.

C. Flexible connection shall be specifically designed to absorb noise and vibration and to prevent damage to equipment caused by piping stress. Unit construction shall consist of heavy bellows type neoprene rubber hose sections with stainless steel liners and attachments to match piping.

1.13 THRUST BLOCKS

A. Plugs, caps, tees, and bends deflecting 22-1/2 degrees or more, either vertically or horizontally, on water lines 6 inches in diameter or larger, shall be provided with thrust blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2-1/2 sand: 5 gravel and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.

PART 2 – PRODUCTS

2.1 PIPING SYSTEMS

A. All piping shall be in accordance with the American Society for Testing and Materials, ASTM A-53. **No foreign made piping or connectors will be accepted in this construction.**

B. Water piping to the pressure reducing station shall be Class 52 ductile iron pipe with mechanical joints.

C. Culinary cold, hot, and recirculating hot water above grade shall be Type "L" copper with soldered wrought copper fittings. 'Pull-T' systems will not be allowed.

D. All buried waste and vent piping below slabs shall be standard weight DWV schedule 40, solid core PVC ASTM F 1488 piping.

E. Waste piping above grade shall be standard weight cast iron pipe with no-hub, tyseal, M-G, or A.B.I. 'Best' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".

F. All cast iron pipe and fittings, above ground, shall bear the collective trademark of the Cast Iron Soil Pipe Institute, or have prior approval of the engineer.

G. Condensate drip lines shall be Type "M" copper with soldered wrought fittings.

H. Gas lines below slab shall be corrugated stainless steel tube (CSST). All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Piping below slab to be encased in a Schedule 40 PVC pipe with long sweep elbow. Casing to terminate 1" above slab. PVC casing to be two pipe sizes larger than carrier pipe but be 2" minimum.

I. Gas lines located outside building and below finished grade shall be ASTM D2513 polyethylene plastic pipe. Fittings shall be ASTM D2513 polyethylene, butt-fusion type; and ASTM D2683, polyethylene socket-fusion type. Installation and piping material shall be in strict compliance with the local fuel supply company requirements.

J. Refrigeration piping shall be Type "L" copper with malleable copper fittings. Piping shall be specifically treated and sealed for refrigeration systems piping, similar to Mueller.

K. NOTE: Pre-charged line sets will be permitted on refrigeration systems with rated capacities below 65,000 BTUH.

L. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

2.2 HANGERS AND SUPPORTS

A. Vertical Piping

1. Attachment - Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and to carry the weight of the pipe and contents. Stacks shall be supported at their bases, and if over two (2) stories in height at each floor by approved metal floor clamps.
2. Cast iron soil pipe shall be supported at not less than each story height and at its base.
3. Screwed pipe (IPS) shall be supported at not less than every other story height.

4. Copper tubing shall be supported at each story for piping one and one-half (1-1/2) inches in diameter and at not more than six (6) foot intervals for piping one and one-quarter (1-1/4) inches in diameter and smaller. Piping shall be wrapped with three wraps of vinyl tape to isolate pipe from ferrous pipe supports.

B. Horizontal Piping

1. Under no circumstances shall piping be supported from the roof deck.
2. It is essential that all piping be supported from roof structure at joist panel point locations.
3. Supports - Horizontal piping shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
4. Cast Iron Soil Pipe - Where joints occur, soil pipe shall be supported at not more than 5-foot intervals, except that where 10-foot pipe lengths are used, supports at 10-foot intervals are acceptable. Supports shall be placed within eighteen (18) inches of the hub or joint. No-hub joints and fittings shall be restrained with rods and clamps per manufacturer's recommendations.
5. Screwed pipe (IPS) shall be supported at approximately 12-foot intervals.
6. Copper tubing shall be supported at approximately 6-foot intervals for piping one and one-half inches and smaller in diameter and at 10-foot intervals for piping two inches and larger in diameter.
7. Piping placed underground shall be laid on a firm bed for its entire length. Hangers shall be Grinnell Figure 260 for both bare and insulated pipe.
8. Insulation inserts and shields for cold surface piping will be provided under Section 22 0700 of these specifications.
9. All copper, fiberglass, or plastic piping shall be securely supported from the building structure at intervals specified and/or as recommended by the pipe manufacturer. Hanger shields for suspended piping shall be functionally similar to isolators with Grinnell Fib. 97. Non-ferrous piping shall be isolated from contact with ferrous supports with three wraps of vinyl tape.

10. Plumbers' tape, chain, or wire will not be permitted for pipe support.

2.3 VALVES AND STRAINERS

A. All valves and strainers shall be by one manufacturer. Approved valve manufacturers are Crane, Stockham, W. C. Norris, Grinnell, or Powell. Crane numbers are used for convenience.

B. Domestic Hot and Cold Water

1. Gate Valves:

a. Valves 2" and smaller shall be Crane No. 428, bronze, screwed, 200# WOG gate valve with solid wedge disc and rising stem.
b. NOTE: If unable to use a rising stem valve because of insufficient clearance, use a Crane No. 438 nonrising stem valve.

2. Globe Valves:

a. Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, 200# WOG globe valve with a replaceable teflon disc and teflon packing. The disc shall be suitable for hot water up to 360 deg. F. at 150 psi.

3. Check Valves:

a. Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, Y-pattern 200# WOG swing check valve. Valves 2" and larger shall be Crane No. 373.

4. Ball Valves:

a. For hot and cold domestic water service: Valves 2" and smaller shall be Crane No. 2190H bronze, screwed, 200# WOG, Gem ball valve with Buna-N rubber capsule. Watts B6000 or Apollo 70-100.
b. For heating service as isolation or balancing valves: Valves 2" and smaller shall be Crane No. 219H, bronze, screwed, 200# WOG, Hydro Gem ball valve with EPT Nordel capsule. (If solder-joint ball valves are desired, use Crane No. 2192H). NOTE: Valves must be suitable for temperature and pressure required in the individual application.

5. Strainers:

a. Strainers 1-1/2" and smaller shall be Crane No. 988-1/2, iron body, screwed Y-pattern, 200# WOG, sediment separators with a 20-mesh Monel screen.
b. All strainers shall be installed with fine mesh supplementary "construction screens" which shall remain in place while the system is flushed and chemically cleaned. The "construction strainer" basket shall be removed just prior to balancing the water systems.
c. Provide blow-down ball valve on all strainers same size as strainer tapping.

C. Gas Service:

1. Ball Valves:
Valves 2" and smaller shall be Crane No. 2330-TF, bronze, screwed, 400# WOG Accesso ball valve with teflon seats, and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

2. Gate Valves:
   Valves 3" and smaller shall be Crane No. 424, bronze, screwed, 400# WOG gate valve with Exelloy seats and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

3. Globe Valves:
   Valves 2" and smaller shall be Crane No. 130, bronze, screwed, 400# WOG globe valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

4. Check Valves:
   Valves 2" and smaller shall be Crane No. 132, bronze, screwed, 400# WOG horizontal lift check valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to 250 psi set by that agency.

5. Pressure Regulators:
   Furnish and install approval type gas pressure regulators in gas piping ahead of each appliance and piece of equipment, to which is connected. Regulators located outside the building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with weatherproof vent and bugproof screen.

2.4 NON-SLAMMING OR SPRING-LOADED CHECK VALVES

A. Types: Provide valves of the fully guided or cone-and-diaphragm types.

B. Bodies: Provide flanged or wafer type bodies constructed of cast iron ASTM A 126, Class B; cast steel ASTM A 216/A 216M, Class WCB; stainless steel, Type 304 or cast bronze ASTM B 61.

C. Trim: Seats, discs and springs shall be constructed of 18-8 stainless steel or bronze complying with ASTM B 62. Seats may be of elastomers suitable for 250 degrees F. minimum continuous working temperature or not less than 50 degrees F. above the operating temperature of the system, whichever is higher.

D. Mating Surfaces: Mating surfaces of closure faces shall be bronze or Type 316 or 17-4PH stainless steel or elastomer approved for the particular service and materials must be compatible to prevent electrolytic action.

E. Pressure Loss: Pressure loss through the valves, measured in feet of water, shall not exceed 6/10 of the water velocity in feet per second.

F. Bubble-Tight: Non-slamming and spring-loaded check valves shall provide bubble-tight shut-off when handling water up to 250 degrees F. and 125 pounds per square inch differential pressure. Design shall prevent rubbing of seat materials when opening and closing. Poppet valves shall have conical springs.

2.5 GENERAL DUTY VALVES & SPECIALTY COCKS

A. Cocks

1. Balancing cocks 1-1/2" and smaller shall be Crane No. 80E, bronze, screwed, 200# WOG.
2. Balancing cocks 2" and larger shall be Crane No. 325, all iron, flanged 125# WOG.
3. Gage cocks shall be Crane No. 744, 1/4", bronze, screwed.

4. Pet cocks shall be Crane No. 702, 1/4", bronze, screwed with lever handle.
5. Try cocks shall be Crane No. 734, 3/8", bronze, screwed, 250# rated with stuffing box.
6. Provide two complete sets of wrenches for all cocks and stops.

2.6 BACKFLOW PREVENTERS

A. Backflow preventers shall comply with requirements of the International Plumbing Code as to type, style, size, location, and arrangement for the actual installed duty.

B. Where backflow preventers are installed which release water thru the valve to the atmosphere, these units shall be provided with drip pans which collect the free water. The drip pans shall be piped to the nearest drain.

C. All backflow preventers shall be installed with all necessary isolation valves and test cocks.

2.7 AUTOMATIC VALVES AND WELLS

A. The mechanical subcontractor shall install the automatic temperature control valves, temperature sensing wells, and flow switches, as directed by the automatic temperature control subcontractor.

2.8 UNIONS

A. Ground joint unions shall be installed on pipe 2-1/2" and under where indicated on drawings. Whenever piping is connected to a major piece of apparatus, unions shall be provided as near as practical on each side of the apparatus.

2.9 ISOLATION FITTINGS

A. Approved isolation fittings shall be installed at the junction of all copper and steel piping to prevent electrolytic action. **Fittings shall be NZR brass unions or fittings.**

B. Optional isolation fittings (IF APPROVED BY OWNER) may be dielectric type with high temperature silicon gaskets.

2.10 THERMOMETERS

A. General: Provide liquid-in-glass type thermometers or Vari-angle digital thermometers as manufactured by Weiss unless bimetal dial type is required due to space limitations or other conditions.

B. Scale and Dial: Provide liquid-in-glass thermometers of the organic liquid type having a nominal scale length of not less than 7 inches. Provide bimetal dial thermometers with a nominal 5-inch dial size graduated through a minimum arc of 270 degrees. Provide a recessed dial so that graduated portion and pointer are in the same plane.

C. Range: Temperature range shall be as shown on the drawings or as specified. Chilled water system 20 degrees F. to 120 degrees F. Hot water system 30 degrees F. to 240 degrees F. Condenser water system 30 degrees F. to 240 degrees F.

D. Case: Provide liquid-in-glass type thermometer with an aluminum alloy or steel case. Provide bimetal dial thermometers with all exposed metal parts, including the case and stem made of 300 Series stainless steel, all welded construction.

E. Accuracy and Calibration: Bimetal dial thermometers shall have zero adjustment for recalibration and shall have an accuracy of plus or minus one percent of span through the complete range. Liquid-in-glass thermometers used for indicating shall have an accuracy of plus or minus 0.5-degree Unless otherwise required in other sections of the specifications, thermometers for commissioning tests shall have an accuracy of plus or minus 0.25-degree F.

F. Thermometer Wells: Provide pipeline liquid-in-glass thermometers with a union connection, tapered bulb chamber and matching taper on well. Provide bimetal dial thermometers with a well to match bulb chamber. Provide wells for insulated pipe of the extension neck type suitable for insulation thickness. Provide wells fabricated of bronze, brass or 316 stainless steel suitable for the fluid or gas in the pipe.

G. Stem: Provide stems with a minimum length of 2-1/2 inches immersion which shall be increased in length as necessary to reach the center lines of the pipes in which they are installed.

H. Adjustment: Provide straight or angle pattern adjustable type thermometers as required to facilitate readings.

I. Thermometers shall be Palmer, Trerice, Marsh or Weiss. Install all thermometers so as to be easily readable from the floor.

2.11 PRESSURE GAUGES

A. General: Provide pressure gauges which comply with ANSI B40.1.

B. Dials: Provide dials not less than 4-1/2 inches in diameter, except that packaged equipment may be provided with manufacturer's standard gauges of equal accuracy.

C. Ranges: Select operating ranges so that during normal service the gauge pointer will be at the approximate midpoint of the gauge scale.

D. Refrigerant Gauges: Provide refrigerant pressure gauges with corresponding temperature scales for the particular refrigerant sensed.

E. Accuracy: Pressure gauges used for commissioning of other equipment shall have a minimum accuracy of 3 percent of span.

F. Gage Cocks: All gages shall be furnished with gage cocks and pressure snubbers.

G. Gauges shall be Ashcroft, Trerice, or U.S. Gage.

2.12 PRESSURE & TEMPERATURE TEST PLUGS

A. Plugs shall be brass body type with Neoprene, Nordel, or Vitron self-closing valve (to suit temperatures of fluid in pipe). Test plugs shall be Pete's Plug or approved substitute. Furnish six pressure and six temperature instruments to Owner to permit reading pressures and temperatures.

2.13 V-BELT DRIVES

A. Capacity of V-belt drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.

B. V-belt drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.

C. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bused type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

2.14 MAGNETIC STARTERS

A. Contractor furnishing "packaged equipment" with 1/2 HP and larger motors shall furnish factory-mounted magnetic starters. Magnetic starters shall provide both overload and under voltage protection and shall have integral hand-off-auto switch, auxiliary contacts, and pilot. All motors installed under this contract shall have a disconnect switch in the immediate vicinity of the motor. Starters on three phase motors shall protect all three legs of the circuit. Starters to be Square "D". (No substitutions).

B. Starters for all motors on other than "packaged equipment" which are furnished under the mechanical section of the work will be installed by the electrical contractor.

C. Starters shall be two-speed type or explosion-proof type where required.

D. Provide a heater index bound in the O & M manual and listed on CD ROM for all starters furnished on the project.

2.15 MISCELLANEOUS ITEMS

A. Motors:

1. Motors shall be furnished and installed under the applicable Mechanical Sections of the Specifications.
2. Each motor shall be provided with a nameplate for the electrical characteristics shown on the Drawings or as otherwise noted.
3. Motors shall be constructed and rated to deliver full nameplate capacity at the project altitude.
4. Horsepower shall be at least equal to that shown on the drawings. Where equipment is submitted and approved for the installation which requires larger motor sizes than shown, the wire and starter sizes shall be increased and means provided for operation and control suitable for the larger motors with no increase in cost to the Owner.
5. Unless otherwise specified, or required for controller sequencing, all motors over 5 HP shall be high efficiency type, and all fractional HP single phase motors 1/2 HP & under shall be permanent split capacitor (PSC) type.
6. Motors for V-belt drives shall be provided with cast iron or steel base, with slide rail and adjustable screw device and shall be isolated by rubber-in-shear devices.
7. Motors shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed and load which may be obtained by the drive actually furnished.
8. Motors provided with automatic control shall be capable of making as frequent starts as the control device may demand. Motors not provided with automatic control shall be capable of making not less than 4 starts per hour.
9. All belt-connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration of incorrect belt tension.
10. Motors shall be air cooled and shall be guaranteed to operate continuously at 115% of full load with temperature rise in any part not to exceed 40 degrees C above the ambient air temperature.
11. Motors shall be open drip-proof or totally enclosed fan cooled type as required, and shall be commercially dynamically balanced and tested at the factory before shipment.

12. Motors shall be selected for quiet operation. Sound power levels shall be within NEMA MGI-12.49.
13. Motors shall comply with requirements of ANSI C 50, NEMA MG-1, and all NEMA standards.
14. Motors controlled by variable frequency drives shall have characteristics which are fully compatible with the drives to which they are connected. Provide written confirmation of coordination with VFD supplier.
15. Approved Manufacturers: Allis-Chalmers, Century, Gould, Lincoln, Reliance, Westinghouse, U.S.

2.16 SEISMIC RESTRAINTS

A. All Division 22 & 23 equipment, piping, and ductwork shall be anchored and seismically restrained as required by the IBC for Seismic Zone D, NFPA 90A (current edition), UL Standard 181, Tri-services Manual Fagel Et Al 1973, and the SMACNA Guidelines for seismic restraints of mechanical systems.

B. The Division 22 & 23 contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with Seismic Zone D of the International Building Code.

C. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment.

D. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal.

E. The above qualified seismic engineer shall determine specific requirements on equipment anchorage and restraints, locations and sizes based on shop drawings for the mechanical equipment which have been submitted, reviewed and accepted by the Owner's representative for this project.

F. The Division 22 & 23 contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed for the equipment shop drawings and certified correct by the equipment manufacturer for Seismic Zone D with direct anchorage capability.

G. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

    1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.
    2. The professional seal of the engineer who is responsible for the design of the Vibration and Seismic restraint System for isolated equipment.
    3. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
    4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.
    5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.

6. The location of all restraints of pipes and ducts with the locations shown on a floor plan noting the size and type of anchorage and restraint to be used.

H. Snubbers

1. Snubbers shall be double acting and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.
2. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch nor more than 1/4 inch.
3. A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.

I. Design and Installation

1. General: All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed or supported to withstand seismic disturbances and remain operational. Provide all engineering, labor, materials and equipment for protection against seismic disturbances as specified herein.

2. All equipment not anchored directly to the floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

3. Isolated Equipment: All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.

4. Piping: All isolated and non-isolated piping 2-1/2" I.D. and larger shall be protected in all planes by restraints to accommodate thermal movement as well as restrain seismic motion. Where necessary the piping restraints shall be resiliently attached to the piping with vibration dampening inserts to prevent the transmission of vibration to the building structure. Locations shall be as scheduled and shall include but not be limited to:

    a. At all drops to equipment and at flexible connections.
    b. At all 45 deg. or greater changes in direction of pipe.
    c. At horizontal runs of pipe, not to exceed 30 ft. O.C. spacing.
    d. Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.

5. Non-Isolated Equipment: The restraint systems for all non-isolated equipment are to be installed to resist stresses produced by lateral forces according to Sec. 2312 of the International Building Code with an Occupancy Importance Factor of 1.5, a Seismic Zone Factor of Z = 0.75 for Zone 3 and a Horizontal Force Factor for Elements of Structures and Nonstructural Components of Cp = 0.3. In addition, the vertical forces restraint requirement shall be half the value of the horizontal forces. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

6. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

    a. Mason Industries, Inc.
    b. Korfund
    c. Amber/Booth Company
    d. Kinitics

7. Manufacture and design of restraints and anchors for internally isolated equipment shall be the responsibility of the manufacturer of the vibration isolators furnished with the equipment.

8. Piping, ductwork, and equipment without moving parts shall be restrained as shown and noted on the drawings. Locations shown are approximate and shall be coordinated with other trades and with the structural engineer at the job site.

J. Field Services

1. The seismic restraint manufacturer's engineer shall inspect the final installation and shall certify that all seismic restraints have been installed per manufacturer's instructions and applicable codes and standards. A letter of certification shall be provided in O&M manuals and on CD Rom.

2.17 CHEMICAL CLEANING

A. Prior to operating any heating or cooling systems, all piping systems and components shall be chemically cleaned and flushed by an experienced chemical cleaning service approved by the Engineer.

B. Pipe Exterior: Wash and wipe pipe exterior to remove construction dirt, loose scale and flux.

C. Pipe Interior: Flush pipe interior with clean water. Continue flushing until the piping system runs clean. After flushing inspect strainer screens, refrigeration machine water boxes, piping low points, and tank drains to determine the presence of construction debris. If debris is found, disassemble equipment and remove debris. Re-flush the system and re-inspect.

D. Do not operate centrifugal pumps until system has been cleaned and flushed.

2.18 GREASING AND OILING

A. Prior to placing the equipment in operation, the bearings on all motors, fans, pumps, etc., shall be properly lubricated with a lubricant suitable for the service.

B. Lubrication instruction tags are to be left on "all" bearings and equipment for the Owner's future use. Only lubricants recommended by the equipment manufacturers shall be used.

C. It shall be incumbent on the contractor to operate the building equipment used for temporary heat, etc., in a prudent manner to ensure that when the building is turned over to the Owner all equipment is in a "first-class" condition.

D. Equipment shall not be operated unless:

1. All safety devices are installed and functioning properly.
2. Filters are in place on fan systems. Filters to be new and clean.
3. Equipment is properly greased and oiled.
4. Belts and drives are properly aligned and adjusted.

E. The contractor shall maintain a current "equipment maintenance" chart in the construction shack at all times. This chart shall be posted in a conspicuous place and shall include all items of maintenance necessary for proper operation of the equipment.

F. Equipment used for temporary heat and cooling shall, if requested by the Contracting officer, have tube bundles pulled by contractor for Owner inspection prior to acceptance.

2.19 VALVE TAGGING

A. All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The contractor shall furnish and install approved engraved plastic tags for all designated items, which numbers and letters on the tags corresponding to those on the charts and diagrams.

B. Tags shall be not less than 1-1/2" diameter with depressed black filled numbers not less than 1/2" high and black filled letters not less than 1/4" high. Tags shall be securely fastened to valves with approved brass "S" hooks, or brass jack chain, in a manner to permit easy reading. Zip ties are not acceptable. Do not attach to valve wheel. Brass tags shall be as manufactured by Seton Name Plate Company, New Haven, Connecticut, or approved equal.

C. Each valve shall have an identifying number identifying the unit. Standard identifications may be used for identifying type of service or fluid in pipe. The contractor shall submit his system of identification to the Owner's representative for approval prior to ordering. Any work done without this approval is done at the contractor's risk.

D. Charts of all valves shall be furnished to the Owner's representative by the contractor.

E. A chart to be mounted in a frame with clear glass front and secured on the wall in the main Mechanical Equipment Room.

F. Second chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at top of plastic closure to allow for affixing approximately an 8" length of nickel-plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plate Company, New Haven, Conn., or approved equal.

G. Identify all valves. A sample identification shall be as follows:

VALVE IDENTIFICATION CHART

NUMBER	DESCRIPTION	LOCATION	NORMAL POSITION
1.	Cold Water Supply to Water Heater	Mech. Room #121	Open
2.	Cold Water Supply to Hose	Room #13	Open
3.	Cold Water Supply to Equip. in Room #12	Room #18	Open
4.	Hot Water Supply to Toilet Room #212	Chase #210	Open
5.	Air Vents - Cooling Coil #12 (2 required)	Fan Room 3122	Closed
6.	Heating Hot Water Balancing Valve (Southwest Zone)	Above Ceiling Room #412	Marked On Valve

The above chart shall reference the room numbers actually used for the project.

H. Mechanical Equipment & Ductwork:

1. All mechanical and plumbing equipment, including meters, fans, pumps, water heaters, and other devices shall be identified with signs made of laminated plastic 1/8" or larger engraved letters. Signs shall be securely attached by rustproof screws or some other permanent means (no adhesives).

2. Information on sign shall include name of equipment, rating, maintenance instructions, and any other important data not included on factory attached nameplate.

3. Signs shall be attached to equipment so they can be easily read.

4. Identify all ducts exposed in mechanical equipment rooms and in ducts and pipe chases. Sample duct identification shall be as follows:

   a. "Cold Duct - High Pressure - To Second Floor System"
   b. "Exhaust Duct - Toilet Room - To EF-3"
   c. "Ventilation Air Duct - To Utility Room #228"

5. Ducts shall be labeled at all wall penetrations and at connections to equipment.

2.20 PAINTING

A. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.

B. Mechanical Contractor: Spot painting for application of pipe and equipment identification markers.

C. All piping exposed to weather. All insulated piping and all piping in equipment rooms of finished areas shall be painted, as required by the painting specifications.

D. Coding, Pipe Identification & Painting:

1. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. Pipes shall be identified at the following locations:

    a. Adjacent to each valve.
    b. At every point of entry and exit where piping passes thru wall or floor.
    c. Every 50 feet on long continuous lines.
    d. On each riser and junction.
    e. Adjacent to all special fittings or devices (regulating valves, etc.)
    f. Connection to equipment.

2. Apply markers to they can be read from floor.

E. Labels and markers shall be of the self-sticking, all temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin, or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

F. Pipe color coding shall be uniform throughout.

G. Background colors shall be as follows:

Yellow:	Dangerous Materials (natural gas condensate, etc.)
Bright Blue:	Protective Materials (filtered water)
Green:	Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)

H. Letters of identification legend shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.

I. Markers shall be installed in strict accordance with the manufacturer’s instructions.

J. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe.

K. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.

L. On bare pipes, painted pipes, and pipes insulated with a firm covering, pipe banding tape matching the background color of the marker shall be used for 360 deg. color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" of each end of marker and should overlap approximately 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.

M. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling is used, letter heights, background colors, banding, and arrow shall be as specified above. Submit sample to Owner's representative before proceeding with work.

2.21 Plastic Marking Tape

A. Provide and install a continuous plastic tape over the top of all underground utilities. Tape shall be placed 1/2 way between finished grade and top of utility line.

B. Plastic marking tape for underground utilities shall be acid and alkali-resistant Polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1 - TAPE COLOR

Yellow	Gas, Oil, Dangerous Materials
Blue	Water systems
Green	Sewer Systems

2.22 Ceiling Markers

A. Use round color-coded stickers on all accessible ceiling tile grid to indicate location of VAV boxes, valves and dampers.

B. Color code as follows:

Yellow	HVAC
Green	Plumbing
Blue	Air
White	Duct valves
Orange	Electrical devices
Red	Fire

PART 3 – EXECUTION

3.1 COORDINATION

A. All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.

B. Provide valves and unions or flanges at all pieces of equipment to allow maintenance.

C. Install all automatic valves, sensor well, flow switches, etc., as directed by the control contractor.

3.2 TESTING

A. All piping shall be tested in accordance with Section 230593 prior to applying insulation or concealing in partitions, wall, etc.

3.3 ACCESS

A. All valves and equipment shall be located to allow easy access for inspection, service and maintenance, test and balance, and operation. If valves are installed in inaccessible locations, it shall be this contractor's responsibility to furnish and install access doors of a type approved by the owner's representative.

B. Locate piping, valves, etc., to allow easy access to and maintenance of equipment. Do not block walkways, filter access, maintenance access, or tube-pull space in equipment rooms.

3.4 LOCATIONS & ARRANGEMENTS

A. All pressure gages shall be so installed as to be easily readable from an eye level 5' -6" above the floor.

B. Test plugs on flow measuring stations shall be unobstructed and shall be arranged in the piping per manufacturer's recommendations.

C. All equipment and accessories shall be installed to facilitate proper service and maintenance in compliance with the manufacturer's recommendations.

3.5 WIRING BY THE ELECTRICAL CONTRACTOR

A. It is the intent of these specifications that all line voltage electrical power wiring and power connections to equipment be furnished and installed by the electrical contractor, unless otherwise specified or shown on the drawings.

B. The mechanical contractor shall coordinate actual job-site power requirements with the electrical contractor prior to installation of power wiring and electrical equipment. The electrical contractor shall provide necessary wiring to electric heat tape as required and shall coordinate with the mechanical contractor the location and capacity of required circuits.

C. When mechanical system components are furnished with remote mounted control panels, alarm bells, alternators, etc. the electrical contractor shall run all required line voltage power wiring as directed by the mechanical contractor. It shall be the mechanical contractor's responsibility to coordinate the work and provide the necessary wiring diagrams.

D. When exhaust fans are provided which are not controlled by the ATC contractor, they shall be wired to local line voltage wall switches. The wall switch locations shall be coordinated with the owner's representative.

E. Line and low voltage control wiring will be furnished and installed by the ATC contractor in accordance with IEC and Division 26. Minimum 3/4" conduit.

3.6 STORAGE AND INSTALLATION OF MOTORS

A. Handle motors carefully to prevent damage, denting and scoring. Do not install damaged motors or components; replace with new.

B. Store motors and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

C. Install motors where indicated on the drawings and in accordance with manufacturer's drawings and in accordance with manufacturer's published installation instructions.

D. Install each direct-connected motor such that it is securely mounted in accurate alignment. The drive must be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

3.7 INSTALLATION OF ABOVE GROUND PIPING

A. Provide piping systems of sizes indicated on the drawings. Systems shall be installed complete.

B. Install piping systems in conformance with ANSI B31.

C. Install piping to allow for expansion and contraction of the piping systems. Provide offsets and swing joint connections at coils, pumps and other equipment to eliminate undue strain to the equipment connections.

1. Connect flanges and tack weld piping systems in place before full circumferential welds are made.
2. Springing of piping at equipment connections will not be permitted.
3. The use of "cold-spring" is not permitted.

D. Branch connections to up feed systems shall be made at the top or at a 45-degree angle above the centerline. Branch connections for down feed systems shall be made at the bottom or at a 45-degree angle below the centerline.

E. Install water piping with a pitch or slope of not less than 1-inch in 40 feet.

1. Provide 3/4-inch diameter plugged drain valves at each low point in mechanical rooms.

F. High Points: At each high point of the piping system provide a 3/8-inch diameter plugged globe valve.

1. Where high points are located in an inaccessible position, provide a 3/8-inch diameter bleed line from the high point of the piping system and extend to an approved location, with access. Anchor bleed piping and provide 3/8-inch diameter globe valve.

G. All installed pipelines shall be straight, free from dents, scars and burrs, with ends reamed smooth and shall remain straight against strains tending to cause distortion during system operation. The Contractor shall make proper allowance for pipeline expansion and contraction so that no unsightly distortion, noise, damage or improper operation will occur.

H. Piping shall be run in a neat and efficient manner and shall be neatly organized. Piping shall be run parallel or at right angles to the building walls or construction. The Contractor shall study the general, electrical, and other drawings to eliminate conflict of piping with structure, sheet metal, lighting, or other services. Unless specified otherwise, no piping shall be exposed in a finished room, all changes in direction shall be made with fittings.

I. All piping shall be clean and free from acids and loose dirt when installed.

J. Temporary pipe plugs of rags, wool, cottons, waste or similar materials shall not be used.

K. All piping shall be so arranged to not interfere with removal of other equipment or devices and shall not block access openings, etc.

L. Piping shall be arranged to facilitate equipment maintenance.

M. Flanges or unions shall be provided in the piping at connections to all items of equipment.

N. All piping shall be so installed to insure noiseless circulation.

O. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated and adjusted at the completion of the work.

3.8 VALVE INSTALLATION

A. After piping system has been tested and put into service, but before final testing, adjusting and balance, inspect each valve for possible leak. Open and close each valve to verify proper operation.

3.9 INSTALLATION OF UNDERGROUND PIPING

A. Coordinate the routing and location of all underground piping with building footings. See structural drawings.

B. Outside pipe placed underground shall be buried deep enough to protect against freezing.

C. Depth of bury of services shall be:

	Minimum	Preferred
Sewer	48”	48”
Water	60”	60”
Fire	60”	60”

D. Services shall be buried at the "preferred" depth unless site conditions require the "minimum" depth as listed above.

E. Handling: Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.

F. Coated and wrapped steel pipe shall be handled in conformance with AWWA Standard C203.

G. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contractor Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable.

H. Copper tubing shall be cut square and all burrs shall be removed.

I. Locating: Where the location of the water pipe is not clearly defined by dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall, in all cases, cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

J. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

K. Copper tubing shall not be installed in the same trench with ferrous piping materials.

L. Nonferrous metallic pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.

M. Plastic pipe shall be insulated against heat from steam lines, water lines, or other heat sources.

N. Placing and Laying: Pipe and accessories shall be carefully lowered into the trench. Under no circumstances shall any of the materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon a compacted sand bed, with recessed excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as required.

O. Where prescribed by the manufacturer of the pipe, gaskets shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gage in accordance with the pipe manufacturer's recommendations. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

P. Laying of gravity drain shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the pipe has a uniform invert. As the work progresses, the interior of the pipe shall be cleared of all superfluous materials.

Q. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints in gravity drain lines shall then be placed, fitted, joined, and adjusted so as to obtain the degree of water tightness required.

3.10 INSTALLATION OF NATURAL GAS PIPING

A. General: Install natural gas piping as shown on the drawings in accordance with NFPA 54 and as follows.

B. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.

C. Unless otherwise indicated, gas piping shall be run exposed. Where concealed piping is indicated, it shall be installed inside of a welded steel casing which is vented on both ends and, in a location, to permit access to the piping casing with a minimum amount of damage to the building.

D. The gas supply pipe shall be of the size indicated on the drawings.

E. A stop cock or tee handled gate valve, with cast-iron extension box and cover, shall be installed in the gas supply pipe near the curb. A brass gas cock shall be installed in the gas supply pipe just inside the building wall. If the gas supply pipe is larger than 2-inch size, a bronze mounted iron body gate valve may be provided in lieu of the brass cock.

F. Joints shall be welded from the seismic shut-off valves to the gas train connections at the boilers. Other non-welded joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed, and all burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered, and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.

G. An approved type gas cock shall be installed in the branch connection to each riser and near each appliance. Plugged or capped outlets for future extensions or connections shall be provided where noted on drawings.

H. Piping shall be graded not less than 1-inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.

I. A full-size tee fitting and a 6-inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.

J. Uncovered, exposed pipes shall be provided with plates at the point where they pass through floors, finished walls, and finished ceilings. Where necessary to cover beads of fittings, special deep escutcheons shall be provided in lieu of plates. Plates shall be not less than 0.018-inch thick. Wall and ceiling plates shall be secured with round headset screws, not with spring clips. Unless otherwise specified, plates shall be of the one-piece types. Wall and ceiling plates may be flat, hinged pattern.

K. Unions shall be installed in the gas piping between the gas burning appliance and the gas shut-off valve serving the appliance.

3.11 EXCAVATION

A. Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the owner.

B. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Sheeting and shoring for the work and for the safety of personnel shall be in compliance with applicable safety standards.

C. Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the manufacturer's installation manual. The trench width below the top of the pipe shall not exceed that recommended in the installation manual. Where no manufacturer's installation manuals are available, trench walls below the top of the pipe shall be vertical, and trench walls above the top of the pipe shall be sloped as required to properly complete the work. Trench width below the top of the pipe shall not exceed 24 inches plus pipe outside diameter (O.D.). Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased cost of the pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

D. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

E. Removal of Unyielding Material: Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials.

F. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

G. Excavation for Appurtenances: Excavation for manholes, catch basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structural footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.12 BACKFILLING

A. Backfill material shall consist of satisfactory material. Backfill shall be placed in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density unless otherwise specified.

B. Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of the pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

C. Replacement of Unyielding Material: Unyielding material removed from the bottom of the trench shall be replaced with satisfactory material.

D. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 4 inches loose thickness.

E. Initial backfill material shall be placed in layers of a maximum of 4 inches loose thickness and compacted with approved tampers to the density of the adjacent soil and to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of pipe for full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Backfill material in this portion of the trench shall consist of satisfactory material at a moisture content that will facilitate compaction free from stones of such size as recommended by the pipe manufacturer, or larger than 2 inches in any dimension, whichever is smaller, except that where the pipe is coated or wrapped for protection against corrosion, the backfill material shall be free of stones larger than 1 inch in any dimension, or as recommended by the pipe manufacturer, whichever is smaller.

F. The remainder of the trench, except for special materials for roadways, shall be backfilled with satisfactory material. Backfill material shall be deposited ad compacted as follows:

3.13 INSTALLATION OF VALVES

A. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility company’s requirements and manufacturer's installation instructions. Install gas shutoff valve upstream of each pressure regulating valve. Each pressure regulating valve shall have an independent vent piped to the outside of the building. Vents shall be terminated with an approved bug screen fitting.

B. Gas Cocks: Provide and install gas cocks at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated on the drawings. Locate gas cocks where easily accessible and where they will be protected from possible injury.

3.14 INSTALLATION OF THERMOMETERS AND THERMOMETER WELLS

A. General: Install thermometers and thermometer wells at locations shown on the drawings and where specified. Install thermometers so that they can be read by a person standing on the floor and with normal illumination.

B. Locations: Install thermometers and thermometer wells as indicated in documents.

1. Thermometer Wells: Drill and tap pipes 5-inch and larger for installation of wells. Provide tees or reinforced welding fittings on pipes smaller than 5-inch for installation of wells. Provide oversize tees or enlarge pipe smaller than 3-inch at points where wells are installed to avoid restriction of flow.

3.15 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges at locations shown on the drawing and where specified.

B. Locations: Install pressure gauges in the following locations, and elsewhere as indicated.

1. At the discharge of each pressure reducing valve.
2. At the water service outlet.

END OF SECTION 230900

SECTION 233000

AIR DISTRIBUTION

PART 1 – GENERAL

1.1 SCOPE

A. Work shall include the air distribution, ventilation, and exhaust duct systems, and all materials, equipment, and labor required to complete the systems shown on plans and specified herein.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. Construct all ducts, plenums, etc., of the gauges specified in the latest editions of the applicable SMACNA manuals, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots.

B. Duct construction and installation details shall comply with the latest edition of the SMACNA Duct Construction Standards.

C. All exhaust ducts shall be -2-inch suction ducts.

2.2 CLOSURE COLLARS

A. A duct ending at a wall or partition shall have the edge turned back to form a closure collar and flanged tight to the wall or partition so that no sharp or ragged edge appears.

2.3 FLASHING

A. Where ducts pierce roof construction, the flashing shall be provided as part of Division 233000.

B. Flashing type shall be coordinated with roof manufacturer.

2.4 FIRE-RESISTIVE ACCESS OPENING

A. When cleanout openings are located in ducts within a fire-resistive shaft or enclosure, access openings shall be provided in the shaft or enclosure at each cleanout point.

B. These access openings shall be equipped with tight-fitting sliding or hinged doors which are equal in fire-resistive protection to that of the shaft or enclosure.

2.5 CLEARANCES

A. Duct systems shall have a clearance from combustible construction of not less than 18 inches. This clearance may be reduced to not less than three inches, provided the combustible material is protected with materials approved for one-hour fire-resistive construction on the duct side.

2.6 EXHAUST OUTLETS

A. Exhaust outlets shall extend thru the roof, unless otherwise noted. Such extension shall be at least 24" to bottom of cap above the roof surface, at least 10 ft. from any adjacent building, property line, or air intake opening into any building, and shall be located at least 10 ft. above the adjoining grade level.

2.7 WALL PENETRATIONS

A. All ducts penetrating structural or architectural walls shall be sealed air and sound tight.

2.8 FIRE RATED SURFACE PENETRATIONS

A. All ducts penetrating fire rated surfaces shall be sealed as directed in 230900.

2.9 DUCTWORK

A. All ductwork shall be fabricated and installed in compliance with the latest SMACNA duct manuals. Sheet metal ducts shall be properly braced and reinforced with and, where they protrude above roof, they shall be properly flashed.

2.10 DUCT JOINTS

A. All duct joints must be sealed airtight as required by Table 1-2 "SEAL CLASSIFICATION" of the "HVAC Duct Construction Manual". The term "seal" or “sealed" means use of mastic or mastic plus tape or gasketing as appropriate.

2.11 DIMENSIONS

A. Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes shown on the drawings are free area inside dimensions. Acoustically-lined ducts shall have outside dimensions increased as required to accommodate the acoustic lining specified and still maintain the free area inside dimensions shown on the drawings.

B. Under no circumstances shall the cross section of any duct be decreased by dents, pipes, or hanger rods running through it unless otherwise indicated on the drawings. Neither shall the shape be changed without approval. No abrupt transitions that restrict the area shall be used. Where necessary to gain clearance, the duct seams may be turned inside. Structural and Architectural drawings shall be consulted for areas with restrictive clearances.

2.12 FIELD VERIFICATION

A. No ductwork shall be fabricated without first field verifying that the available space (under actual job conditions) will permit installation of the ductwork without structural or other conflicts.

2.13 EXHAUST FANS

A. Ceiling Type

1. Furnish and install complete the ceiling-mounted exhaust fans shown and specified on the drawings.
2. Fan shall have acoustically insulated housing for quiet operation. Air deliveries shall be as indicated on the drawings and shall be certified by AMCA performance tests.

3. Fan shall have centrifugal wheel direct connected to motor. Ceiling grille shall be all aluminum construction with satin finish. Entire fan, motor, and wheel assembly shall be removable without disturbing the housing. Fan speeds shall not exceed 1100 RPM. Unit shall be complete with backdraft damper.

2.14 PACKAGED HEAT PUMP UNIT

A. Furnish and install complete the air-to-air split system packaged air conditioner shown and specified on the drawings.

B. Evaporator section shall be ceiling mounted type with pre-charged refrigerant system, packaged controls, swing flow outlet air louvers, and packaged, integral, concealed drain pump. Unit shall be complete with filter section, hard wired, wall mounted thermostat, and all controls for automatic operation.

C. Additional condensate lift pump capable of 10 feet of head shall be provided per drawings. Pump to be complete with leak detection alarm. Pump to be Little Giant or approved equal.

D. Condensing unit section shall be complete with high performance hermetic compressor with high- and low-pressure safety controls, air cooled condenser with modulating fan controls for operation at outdoor air temperatures as cold as 0 deg. F. Provide hard wired, wall mounted heating/cooling thermostat, auto changeover and all controls for automatic operation.

E. Heating section shall be electric

F. Unit shall be Mitsubishi, Lennox, Carrier, LG, or approved equal.

2.15 DRYER BOX:

A. Recess wall type for stud frame or CMU wall. 22 Gauge aluminum construction.

B. Dryer box shall be by Dryerbox or equal.

2.16 ELECTRIC RADIANT HEATING PANELS

A. Furnish and install complete the electric radiant heating panels shown and specified on the drawings. Heating panels shall be constructed of insulated Solid-State Heating element. The element shall be backed with one-inch thick, high density, odorless fiberglass board, faced with a white finely textured aluminum face and framed in aluminum. Panels shall reach the full surface temperature in five minutes. Radiant output shall be 95% of input energy. Panels shall be listed under UL Standard 2021.

B. Panels shall be factory stenciled to match architectural lay-in ceiling tile pattern. Coordinate with project architect.

C. Panels shall be Enerjoy II or approved equal.

2.17 UNIT HEATERS (Electric)

A. Furnish and install in the locations shown on the plans the electric unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.

B. The electric heating coils shall be heavy duty, low watt density, fin tubular construction. The heating coil section shall include U.L. listed safety switches to protect the system from overheating.

C. Unit casings shall be of not less than 16-gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

F. Units shall be furnished with 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

G. Unit heaters shall be Chromalox, Markel or approved equal.

2.18 UNIT HEATERS (Gas Fired)

A. Furnish and install in the locations shown on the plans the sealed combustion gas-fired unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.
B. Heat exchangers shall be either open or sealed type as shown on drawings and shall be aluminized steel designed to accommodate thermal stresses without internal damage. Burners shall be AGA approved with 24-volt control circuit and automatic safety pilot.

C. Unit casings shall be of not less than 16-gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.
F. Units shall be furnished with 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

G. Provide factory combination vent and intake kit. Coordinate with drawings for vertical and horizontal kit locations.

H. Unit heaters shall be Reznor, Hastings, Lennox or approved equal.

2.19 FILTERS

A. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each unit filter bank and store on site as directed by Architect.

B. Filter bank shall consist of MERVE 9, 40%-45% efficient (ASHRAE 52-5 test standard) replaceable media type air filters. The supporting front grid of each filter section shall be hinged to facilitate easy replacement of filter media. Filter frames shall be of 18-gauge galvanized steel construction with 11 gauge galvanized steel wire grids to support the media.

C. Air filter banks shall be Cambridge, AAF, or Eco-Air.

2.20 DAMPERS – GENERAL

A. Damper frames shall be of not less than 18-gauge galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.

B. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must be of not over 6" in width. Blades shall be secured to 1/2" diameter zinc-plated axles by zinc-plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon-coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blades linkage hardware shall be constructed of corrosion-resistant, zinc-plated steel and brass.

PART 3 – EXECUTION

3.1 JOB SITE CONDITIONS:

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that the work of this section may be installed in accordance with all pertinent codes and regulations in the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Owner.
2. Do not proceed with installation in areas of discrepancy, until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF EQUIPMENT

A. Install all equipment with adequate space for service and maintenance.

B. Care shall be taken to avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner's representative.

END OF SECTION 233000

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DIVISION 25 – INTEGRATED AUTOMATION

Section 25 1000 Automatic Temperature Controls

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SECTION 25 1000

AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS:

A. The General Conditions, Supplementary General Conditions, alternates and addenda, applicable drawings and the technical specifications, shall all apply to all work under this division.

1.2 SYSTEM DESCRIPTION

A. A system of DDC automatic temperature controls shall be furnished and installed as a part of this contract as an extension of the existing system to give the owner a completely operable system.

1. Acceptable manufacturers and installers shall be:

a. Johnson Control as installed by Johnson Controls SLC, Utah Branch.
b. Johnson Control as installed by CCI Controls, SLC, Utah.
c. Structureware as installed by Utah/Yamas Controls, SLC, Utah.
d. Johnson controls as installed by Automated Controls & Electrical Service.

B. DDC system shall be Ethernet/Network compatible. System shall be accessible from any remote site through an Ethernet or internet connection. A direct Lan Connection is required to all equipment, VFD's, controllers, etc. No integrators will be allowed.

C. Entire building system shall tie into TSD Lan Network.

D. The system shall be as indicated on the drawings and specified herein. Building HVAC systems and unitary heating devices shall be entirely controlled by the DDC system. System shall include local DDC controllers mounted at each fan system, These local DDC controllers shall be interconnected by a 2-wire LAN (local area network) with a master/central DDC controller located as directed by owner. The master/central DC controller, in turn, shall communicate with both the existing school district host computer located in the district offices and a man-machine interface device located in the Main Custodian office. This interface device shall be a Pentium based computer as specified below. Device shall display on separate, bit-mapped color screens each fan system, cooling system, etc. Each screen shall have available for display in the appropriate location each input and output point monitored or generated by the DDC system. All digital output points shall have override capability. All screens shall be password protected so that sensitive data cannot be easily corrupted by inexperienced operators while allowing complete access to trained maintenance personnel. All of the above screens, data and features shall also be available for monitoring and modification from the Host computer located in the District offices via Networking (Ethernet) connections.

E. The latest technology DDC/Energy Management systems will be furnished and installed. As a standard, these systems will include a personal computer (PC), "front end", complete with 12" color (SVGA) monitor, printer, mouse, enhanced keyboard and modem/communications port for remote access from the district office. Graphics and data files for each building will be installed within the local PC and also at the Tooele S.D. maintenance office. Communication between the local system and the maintenance office will be completed and verified. Local system shall be located in a location directed by owner.

F. The DDC/Energy system will be capable of different access levels for the different control and engineering functions of the system. The Tooele School District maintenance staff will have access at the highest level to allow for DDC program, graphic pages, and other changes and additions.

G. The DDC/Energy Management system will have dynamic alarm display capability. If an alarm should occur at a remote location or system, that alarm shall generate a message on whatever screen happens to be on the current display. All alarms shall be logged on the system printer. The system will be capable of printing logs and trends. It will also be capable of displaying graphic trend information for all points.

H. The DDC/Energy Management system will have a graphic page for each major mechanical piece of equipment or system (I.E.: rooftop units, exhaust fans, etc.). From these pages, there will be “live” readouts of temperatures, pressures, RH levels, on/off status, valve and damper positions, outside air temperature, etc. It shall be possible from this screen to perform setpoint changes, equipment on/off overrides, implement “test” status and values, without additional screen or program manipulation.

I. Functions such as equipment schedules and reset schedules shall be accessed from editing screens. All functions shall be protected with different levels and passwords.

J. There will also be a floor plan(s) which will show the location of rooms, room sensors, etc., and will give a “live” display of the current condition of that location. Room temperatures will be adjustable from this graphic. Outside air temperature will also display on this graphic. Larger buildings will require more than one of these floor plan pages. No more than 40 points should be on any one page.

K. All system and unitary controls shall be of the direct digital type (DDC). Self-tuning PID (Proportional, Integral, Derivative) control algorithms shall be applied where applicable on all applications. The control system shall be a networked, distributed intelligence system, with the control loops for each system being capable of stand-alone operation.

L. ATC contractor shall provide a 5-minute UPS system for the main ATC computer located as directed by owner. UPS shall be used during changeover to emergency power.

M. The system shall include all control devices, valves and damper parts as called for hereinafter.

1.3 SCOPE

A. The control system shall consist of electronic type, direct digital controllers, input/output modules, ATC interface panels, and accessory equipment for a completely installed system of automatic temperature controls and motor starting circuit control.

B. Provide the following:

1. Man-machine interface device or
2. Host Computer System
3. Master DDC Control Panel
4. Local DDC Control Panels
5. ATC Interface Panels
6. Local Area Network Wiring & Setup
7. Heat Pump Unit Control
8. Electric Radiant Ceiling Panel Control
9. Electric Unit Heater Control
10. Gas Unit Heater Control

11. Room Temperature Control
12. Building Fire Alarm Interlocks
13. Exhaust Fan Control
14. Water Flow Alarm
15. Domestic Hot Water System Control
16. Space Temperature Alarms

1.4 WORK TO BE PERFORMED BY OTHERS

A. Division 26 shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, VFD's and motors. Division 26 shall also provide 120 VAC. The ATC contractor shall be responsible for all step-down transformers and 24 VAC wiring to ATC equipment.

B. The sheet metal contractor shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. To ensure that the damper both opens and closes completely with less than 7#/sq. ft. torque applied at the operating shaft, each damper shall be checked after its installation, but before the damper actuators are attached. Dampers not properly installed or meeting this torque requirement shall be replaced and/or reinstalled without additional cost to the ATC contractor or the Tooele County School District.

C. The mechanical contractor shall install all valves, immersion wells and pressure taps supplied him by the ATC contractor.

1.5 INSTALLATION BY AUTOMATIC TEMPERATURE CONTROL (ATC) CONTRACTOR

A. The ATC contractor shall furnish and install all necessary electrical control wiring and conduit for the complete temperature control system, heating and ventilating equipment motor starting circuit controls and all electrical control interlocks for same, and for control wiring for miscellaneous HVAC equipment furnished by the Owner.

B. The ATC contractor shall furnish & install all necessary electrical control wiring and conduit of all temperature controls, heating and ventilating equipment motor starting circuit controls, all electrical control interlocks for same and for miscellaneous packaged equipment.

C. **All line and low voltage electrical and control wiring shall be installed in “white” EMT conduit** & in accordance with the 2018 version of the National Electrical Code and applicable local codes and in accordance with Division 26 of this specification. 3/4” nominal trade conduit shall be installed. Plenum cable may be installed as long as it is installed inside EMT or intermediate or rigid metal tubing. When connecting to controllers etc. that have no provisions for EMT connections, EMT may terminate in a junction box located within 36” of the equipment controller. When making a transition between EMT and plenum cable, protect cable from abrasion by installing an insulating connector or equivalent on the exposed end of the EMT. All ATC rough-in boxes shall be identified with the letters “ATC” written across the inside of the box. In addition, each ATC cover plate shall be painted white with the letters “ATC” stenciled in black.

1.6 QUALITY ASSURANCE

A. Provide a **TWO-YEAR** parts and service warranty. This warranty shall commence at the time of demonstration of system completion of portions of the ATC system. Emergency response (for system operation and life safety) by contractor shall be available 24 hrs/day 7 days/week 365 days/year. Response time shall not be greater than 12 hours from time of call.

B. All parts and material and their installation methods shall be in accordance with the manufacturer's recommendations and specifications. All parts and material shall be new.

C. The Contractor or firm executing the work of this section shall have at least 5 years' experience in completing work of similar scope and nature to that specified.

1.7 SUBMITTAL AND TECHNICAL INFORMATION

A. Submit shop drawings (6 sets) and manufacturer's data for the following items to the mechanical engineer:

1. Wiring and installation diagrams.
2. ATC device specification sheets
3. Point list
4. Control flow diagrams, complete with all control schematics and sequences of operation.
5. Documentation of all software and hardware. These manuals shall be complete with installation procedures as well as start up and programming instructions. They should also contain any testing or maintenance procedures required to operate system on a continuing basis.

1.8 PROJECT COMPLETION REQUIREMENTS

A. Upon completion of the project, the ATC contractor shall spend a minimum of 24 hours with the Tooele School District maintenance personnel to adequately instruct them on the operation and maintenance of the system. These training sessions shall be scheduled at times convenient to the School District and shall be conducted at the project.

B. Provide a digital copy and (2) copies on a stick drive of the project operating and maintenance instruction manuals for use during the training sessions. Each manual shall contain all system components and DDC system programming.

C. The ATC contractor shall provide as part of his contract the on-site services of a programmer familiar with the system for an additional 16 hours which the Engineer and/or the School District may use as they see fit to fine-tune or add features to the system.

D. The ATC contractor shall provide as part of his contract the on-site services of a technician familiar with the system to assist the air & water balance contractor in completing his portion of the project. The technician shall be available for a minimum of an additional 24 hours for this assistance.

E. The ATC contractor shall provide as part of his contract the on-site services of a technician familiar with the system to assist the Independent Commissioning Contractor in completing his portion of the project. The technician shall be available for a minimum of an additional 16 hours for this assistance.

F. Operation & Maintenance Manuals: Provide 4 manuals in addition to those manuals specified above. These manuals shall provide descriptions of maintenance procedures for all system components, including sensors and controlled devices. They shall cover inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components. They shall include complete as-built ATC installation drawings with sequences of operation for all mechanical systems controlled by the ATC contractor. They shall each include both a hard copy & CD Rom of all as-built system programming.

PART 2 – EQUIPMENT

2.1 DDC INPUT DEVICES:

A. All DDC input devices shall provide industry standard signals and shall be compatible with the DDC controllers used.

B. All temperature input devices shall have a rated accuracy of 1% or better.

C. Temperature input devices for coils on rooftop units shall have averaging elements.

D. All pressure input devices shall have a rated accuracy of 2% or better. Pressure transmitters shall be selected to match the application and shall not be damaged by pressures at five times the maximum measurable pressure.

E. Miscellaneous input devices shall have accuracies as individually specified. All miscellaneous devices shall be specifically identified (with specifications) with submittals.

2.2 DDC OUTPUTS

A. Modulating outputs shall be in accordance with industry standards and shall be compatible with the driven DDC devices.

B. Outputs shall be 0-10 VAC/VOC or 0.5 sec - 5.0 sec. 4-20 MA.

C. DDC digital outputs shall be either relay contact closures or Triacs rated for the application.

2.3 ROOM THERMOSTATS

A. Wall-mounted space temperature thermostat. Thermostat shall have an adjustment dial that can be given a programmable setpoint adjustment range of ± 5 deg. F. by room occupant. Setpoint range shall be adjustable by owner through building control system.

B. Thermostats in gym area shall be complete with a protective wire cage removable by owner for service.

C. Thermostats for air handling units shall be coordinated with provided to provide thermostats compatible with unit and BMS.

D. Provide a blank plate sensor at Boys toilet room.

2.4 AIR QUALITY TRANSMITTERS

A. Air quality transmitters shall be CO2 type sensor and suitable for duct mounting and shall have an averaging sensor whose length is the width of the return air duct. Output signal shall be 0-5 or 0-10 VDC as required by the DDC system.

2.5 HOST COMPUTERS

A. The School District facility management and control system includes an existing Centralized Host computer currently located at the District offices. Networking, lines, and software shall be furnished and installed by Division 251000. Communication shall be completed to the Tooele County School District office by Division 251000.

B. The most current versions of all necessary controlling & monitoring software & graphic displays shall be installed on the District Centralized Host computer. These shall include but not be limited to Microsoft Windows XP, DDC operating system and building data files.

C. Copies of all software disks, operation manuals, along with installation instruction shall be provided to owner.

D. All new software releases available within one year of the substantial completion date shall be provided to the owner and installed at no additional cost to the School District.

E. Building host computer shall have as a minimum the following:

1. PC with INTEL CORE i5 3.0 GHz CPU (Minimum)
2. 8 GB minimum of RAM memory
3. 1.0 TB minimum hard drive
4. One CD/DVD rom
5. Three button mouse w/mouse pad
6. 24” optical LCD screen
7. Microsoft Windows 7 Pro Operating System
8. 500-watt UPS backup power capable of a 15-minute backup of system
9. Provide all documentation, supporting hardware and software

F. The controlling software data base shall be constructed by the ATC contractor to Tooele School District requirements. Contractor shall consult with Tooele School District to verify these requirements as a part of this contract. Contractor shall provide a fully operational DDC control system that may be monitored, controlled, and modified from the District Centralized Host computer. All control schedules, algorithms, and control logic shall be in place within each DDC controller and stored as back-up copies on both Host computers hard disks which may be downloaded to individual DDC controllers as necessary. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. A hard copy paper printout of points for each device shall be provided. Copies shall be provided in O&M manual and CD Rom.

G. The building shall be represented by complete graphical floor plans, with accurate locations of each major piece of HVAC equipment. A zoom feature shall allow the operator to select any of the main fan systems and see a graphical representation of the system with dynamic representation of all appropriate DDC input & output devices. Each major piece of HVAC equipment shall be graphically represented at each Host computer with all appropriate DDC points dynamically represented.

H. All designated building alarms shall be automatically reported as they occur as determined by the Tooele County School District.

2.6 Internet Based Communication

A. Web Based Operator Interface

1. The BMS shall provide a web based graphical interface that allows users to access the BMS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BMS to a web browser.

2. A web server computer will be supplied (as approved by TSD). The web server shall the latest server software developed by Microsoft. It shall communicate with the latest internet browser software from Microsoft, Netscape or Mozilla (Firefox).

3. All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by the TCSD).

4. The web interface shall not require modification or creation of HTML or ASP pages using an HTML editor. All graphics available at the BMS graphical workstation shall be automatically generated to a web server.

5. The web-based interface shall provide the following functionality to users, based on their access and privilege rights:

    a. Logon Screen - allows the user to enter their name, password and domain name for logging into the web server.

    b. Alarm Display - a display of current BMS System alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages. Any alarm acknowledgments initiated through the web interface will be recorded to the BMS System activity log.

        1) Alarm screen to be visible at all times.

        2) Alarms to be in a standard format indicating:

            a) Alarm Priority
            b) Description
            c) Date and Time
            d) Condition (Alarm/Normal)

    c. Graphic Display - Display of system graphics, including animated motion, available in the BMS system workstation will be available for viewing over the web browser. Software that requires the creation of dedicated “web” graphics in order to display the BMS data via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphics displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user account rights.

    d. Point Details - users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access.

    e. Point Commanding - users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BMS system central workstation activity log.

B. Dynamic Color Graphic Displays

1. Capability to create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including, but not limited to, air handling units, radon ventilation systems, and room level terminal units.

2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of AutoCAD or scanned pictures for use in the system.

3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays and shall automatically update to represent current conditions without operator intervention and without predefined screen refresh rates.

    a. Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the operator interface software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.
    b. Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the set point.
    c. Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
    d. Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or set point.
    e. State text for digital points can be user-defined up to eight characters.

4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.

5. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g.doc, .pdf, .xls, etc.), Internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

6. The Windows environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

7. Off the shelf graphic software shall be provided to allow the user to add, modify or delete system graphic background displays.

8. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.

9. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.

2.7 Master DDC Control Panel

A. The master DDC control panel for the building shall be mounted in a NEMA 1 enclosure in the Main Custodian office or as directed by the owner. The ATC contractor shall furnish and install a Network/Ethernet connecting device via District supplied network lines to the District host computer.

B. The master DDC control panel shall have a capability of overriding all RTU control. Panel shall have override indicating light. Override shall be programmed for 3 hours and be interconnected to building DDC system.

C. The master DDC controller shall have at least two RS-232 serial ports for connection to external devices. One port is to be connected to a Network/Ethernet connection, the other is to be connected directly to the local Host computer system.

D. The master DDC controller shall be 16-bit microcomputer based, providing a multi-tasking operating system for control functions simultaneous with all other facility management, operator interface, and system communications functions.

E. The master DDC controller shall provide true floating-point arithmetic calculations. To accommodate accumulation of large, totalized values, this controller shall support calculation and accumulation of values up to 10 to the thirty- eighth power.

F. The master DDC controller shall provide to the Host computer diagnostic reports of the following types, for all DDC devices:

1. When specified alarm conditions occur, provide a report internally listing the status of specific items associated with the equipment generating the alarm.

2. Report shall be routed to the local Host computer, District Host computer or other combinations of computers via Network as designated by the owner. Depending on the time of day, the owner shall specify up to five sites to which exceptions shall be auto-dialed and reported. This shall allow the owner to assign off hours exception responses to various facility personnel as necessary. Selection of the sites to be dialed can be programmed by the owner and set to change automatically per time of day and day of week. Information may be duplicated to multiple combinations of locations.

3. Report shall record the time the status information was taken and shall allow operational personnel to use this information to diagnose the alarm situation.

    a. Trend logs.
    b. Energy reports.
    c. Exception tables/by operator
    d. Override information table/by operator
    e. Run time information on equipment
    f. Review of specific facility information by operators.

G. All programming defining the functions to be performed by the master DDC control panel from loss due to power failure for a minimum of six months.

H. The master DDC control panel shall be multi-tasking and shall provide the capability to simultaneously perform at least, but not limited to, the following functions:

1. Downloading of application program changes without affecting the simultaneous operation of existing operating application programming.

2. Operator access to the entire network of local digital controllers.

2.8 LOCAL DDC CONTROL PANELS

A. Local DDC control panels shall be located near mechanical systems as necessary to provide both digital and analog input and output points as specified and/or required to achieve specified system performance.

B. Each local DDC control panel shall provide all control functions for the mechanical equipment specified to be controlled from that panel.

C. Every input and output point shall be well labeled, and every digital output shall have a LED indication of the position of the output relay.

D. ATC contractor shall provide documentation of the software application program for each digital controller.

E. Documentation provided shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. Complete ATC drawings including terminal connections shall be available at each local panel.

F. System acceptance shall not be completed until this documentation is provided and located in each ATC interface panel.

G. Systems providing modulating outputs via pulse width modulation techniques, shall provide within each ATC interface panel all the components required to implement the functions equivalent to an analog output.

2.9 INTERFACE PANELS

A. Interface panels shall be mounted near each group of local DDC controllers other than VAV box controllers. Each panel shall be made of not less than 16 gage steel. Panel shall have a full back plate and full hinged door such that when the door is closed, the assembly provides a completely enclosed, NEMA enclosure. Panels shall be fully painted and fitted with key locks. Appropriately sized nameplates shall be used to identify all panel mounted devices. Major wiring within panels shall installed within distribution gutters (similar to Panduit). All wiring entering and leaving panels shall terminate on numbered terminal strips. All wiring within panels shall be color coded and the color shall not be changed between the terminal strip and the end destination of that wire. Panels shall contain wiring diagrams of the panel interior and associated devices. Diagrams shall identify all interior devices and shall include terminal numbers.

B. Panels shall contain the following devices as applicable:

1. Control transformers
2. NEC required fusing
3. Local DDC controllers (owner requirement)
4. NEC required grounding
5. Logic relays
6. 120 VAC convenience outlets
7. Control switches
8. Pilot lights
9. Terminal strips
10. Status indicating lights

2.10 LABELING

A. All ATC supplied panels and devices shall be permanently labeled with engraved plastic laminate labels indicating device name, system identifier and function within the system.

PART 3 – EXECUTION

3.1 SEQUENCE OF OPERATION

A. All settings specified below are initial settings only and must be field adjusted to satisfy actual jobsite conditions.

3.2 FIRE ALARM FAN SHUT-DOWN: (All Fan Systems)

A. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be "normally energized" and shall be installed by Division 26 at each fan system.

3.3 GAS FIRED UNIT HEATER CONTROL

A. A room temperature sensor, acting through a DDC controller, shall cycle the gas fired unit heater to maintain desired room space temperature.

3.4 TOILET ROOM EXHAUST FANS

A. Ceiling mounted; toilet room exhaust fans shall be individually controlled operated by pre-determined schedules from the building DDC system.

3.5 ELECTRIC RADIANT CEILING PANEL CONTROL

A. During OCCUPIED mode, space temperature sensors, acting through DDC controllers, shall modulate their respective radiant panels to maintain desired space temperature.

3.6 ELECTRIC UNIT HEATER CONTROL

A. A wall-mounted line voltage thermostat shall control the unit heater and fan to maintain space temperature setpoint with a room thermostat reading to the BMS.

3.7 PACKAGED AIR CONDITIONER/HEAT PUMP

A. Occupied Mode:

1. The individual unit will run on its own heating/cooling thermostat. The room sensor will monitor the space temperature. Thermostat shall be hard wired.

B. Unoccupied Mode:

1. The DDC system will monitor space temperature.

C. Sequence of Control:

1. Cooling Mode:

a. When the space temperature rises above setpoint, an alarm will be sent to the district computer.
b. Setpoints shall be adjusted to prevent overheating to space as determined by owner.

2. Heating Mode:

a. When the space temperature falls below setpoint, an alarm will be sent to the district computer.
b. Setpoints shall be adjusted to prevent space low temperature as determined by owner.

3.8 AREA SECURITY TEMPERATURE ALARMS

A. Temperature sensors located in an area served by each fan system shall continuously monitor the space temperature and alarm the building Host computer anytime the space temperature drops below or rises above preset setpoints. The Host computer shall then notify the District Remote Security Facility that an alarm has occurred.

B. Provide low temperature sensors in the (2) existing fire riser rooms.

C. Provide high temperature alarm at the Imaging Room.

D. Upon receiving an alarm, the Host computer at the school and at the District Offices shall indicate which area(s) of the building are in alarm through a graphic floor plan display of the building(s). Current space temperatures shall also be displayed at the Host computer.

3.9 DOMESTIC WATER FLOW SECURITY SENSOR

A. A paddle type, water flow sensor located in the 1/3, 2” domestic water line downstream from the pressure reducing valve, shall through the DDC system, signal the Host computer any time flow is sensed during the UNOCCUPIED mode. The Host shall in turn signal the District Remote Security Facility of the alarm. The paddle shall be a Potter Model VSRF and shall be furnished and wired by the ATC contractor and installed by the plumbing contractor. ATC contractor to coordinate size required.

B. Paddle is available from ADI (801) 972-8787.

3.10 DOMESTIC HOT WATER SYSTEM – 120 Deg F.

A. There is a single domestic hot water heating system; 120°F. System consists of a hot water heater and recirculation pumps. When the building is in OCCUPIED mode, the 120°F system hot water heater & its associated pump shall be enabled & the recirculating pump shall cycle from a strap-on sensor to maintain 100°F return water temperature. When the building is in UNOCCUPIED mode, the hot water heater & the recirculating pumps shall remain off.

B. DDC shall monitor pump status for CP-1 and hot water temperatures of 120° F. system.

C. Once enabled by the DDC system, the domestic hot water heater shall operate under the factory supplied controls.

BUILDING DDC SYSTEM INPUT/OUTPUT POINT SUMMARY:

The ATC contractor shall furnish and install all DDC controllers, sensors, interface relays, wiring and other field accessories for the DDC system to provide for implementation of the above sequences of operation and including the input-output points. All points shall be displayed on-password-protected graphic screens on both the existing District host computer and the man-machine interface or Host computer located in the boiler room as determined by building owner.

END OF SECTION 251000

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DIVISION 26 – ELECTRICAL

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SECTION 260001

ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Architectural, Structural, Mechanical and other applicable documents also apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. The contract documents indicate the extent of electrical work. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system as described in divisions 26, 27, and 28.

1.3 RELATED SECTIONS:

A. Other Divisions relating to electrical work apply to the work of this section. See other applicable Divisions including, but not necessarily limited to:

1. Division 1 – General and Supplementary Conditions
2. Division 2 – Existing Conditions
3. Division 3 – Concrete
4. Division 5 – Metals
5. Division 6 – Wood, Plastics, and Composites
6. Division 7 – Thermal and Moisture Protection
7. Division 8 – Openings
8. Division 9 – Finishes
9. Division 21 – Fire Suppression
10. Division 22 – Plumbing
11. Division 23 – Heating Ventilating and Air Conditioning
12. Division 27 – Communications
13. Division 28 – Electronic Safety and Security

1.4 INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS:

A. Prior to bidding the job, submit requests for clarification in writing to the Architect/Engineer prior to issuance of the final addendum.

B. After signing the contract, provide all materials, labor, and equipment to meet the intent, purpose, and function of the contract documents.

C. The following terms used in Division 26, 27, and 28 documents are defined as follows:

1. "Provide" - Means furnish, install, and connect, unless otherwise indicated.
2. "Furnish" - Means purchase new and deliver in operating order to project site.
3. "Install" - Means to physically install the items in-place.
4. "Connect" - Means make final electrical connections for a complete operating piece of

equipment. This includes providing conduit, wire, terminations, etc. as applicable.

5. "Or Equivalent" - Means to provide equivalent equipment. Such equipment must be approved by the Engineer prior to bidding.

1.5 EXAMINATION OF SITE:

A. Visit the site and verify existing field conditions prior to submitting bid.

B. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.6 QUALITY ASSURANCE:

A. Perform work in accordance with all governing codes, rules, and regulations including the following minimum codes (latest editions or as otherwise accepted by the Authorities Having Jurisdiction):

1. National Electric Code (NEC)
2. International Building Code (IBC)
3. International Fire Code (IFC)
4. International Mechanical Code (IMC)
5. International Plumbing Code (IPC)
6. American Disability Act (ADA)
7. National Electrical Safety Code (NESC)
8. Local Codes and Ordinances

B. Comply with all standards where applicable for equipment and materials including the following minimum standards:

1. Underwriter's Laboratories (UL)
2. American Society for testing Materials (ASTM)
3. Certified Ballast Manufacturers (CBM)
4. Insulated Cable Engineers Association (ICEA)
5. National Electrical Manufacturer's Institute (NEMA)
6. American National Standards Institute (ANSI)
7. Electrical Testing Laboratories (ETL)
8. National Fire Protection Association (NFPA)
9. Institute of Electrical and Electronics Engineers (IEEE)
10. American Institute of Electrical Engineer's Electrical Power
11. Systems and Grounding in Commercial Construction
12. Illuminating Engineers Society (IES)

C. Provide new electrical equipment conforming to all requirements as set forth in the above standards. Provide UL labeled equipment where such label is applicable.

D. Comply with all state and local codes and ordinances. When conflicts occur among codes, standards, drawings, and/or specifications, the most stringent requirements shall govern.

E. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Provide a certificate of approval to the owner's representative from the inspection authority at completion of the work.

F. Provide only first-class workmanship from competent workers, conforming to the best electrical construction practices.

G. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.7 SUBMITTALS:

A. The contractor shall submit complete shop drawings and other required submittals. Incomplete submittals will be returned to the contractor unreviewed. No time extensions or cost increases will be allowed for delays caused by the return of incomplete submittals.

B. Shop Drawings: After the contract is awarded, but prior to manufacture or installation of any equipment, submit eight (8) complete sets of shop drawings. Partially complete sets of shop drawings are not acceptable. Submit all shop drawings in one complete submittal package. Prior to submitting shop drawings, review and certify that they are in compliance with the contract documents; Sign all approved shop drawings. Allow a minimum of two weeks for architect/engineer to review shop drawings. Refer to architectural general provision section for additional requirements.

C. Provide equipment catalog “cut sheets”, brochures and/or drawings which clearly describe the proposed equipment. Include plans, elevations, sections, isometrics, and detailed engineering and dimensional information as applicable including equipment room layouts. Electrical room layouts are required to show all electrical equipment locations for all projects that include electrical rooms. Do not submit catalog sheets which describe several different items in addition to those items to be used, unless all relevant information is clearly identified. Bind each information set in three ring binder or binders of sufficient size or sizes to enclose all information. Organize all information by section. Provide separate tabbed covers for each section of Divisions 26, 27, and 28, indicating section number for each section requiring submittals.

D. Include on front cover of binder or binders the name and location of the project, architect, electrical engineer, general contractor, electrical contractor, subcontractors, supplier/vendor, order number, volume, date, and any other applicable information. Certify that shop drawings are submitted in accordance with the contract documents with a written statement indicating compliance. Submittals will be reviewed and comments produced two times maximum. Additional reviews will be billed at current rates.

1.8 OPERATION AND MAINTENANCE MANUALS:

A. Submit four (4) complete sets of operating instruction and maintenance manuals for all equipment and materials provided under Divisions 26, 27, and 28.

B. Provide manufacturer's recommended operating and maintenance instructions, cleaning and servicing requirements, serial and model number of each piece of equipment, complete list of replacement parts, performance curves and data, wiring diagrams, warranties, and vendor's name, address, and phone numbers. Do not submit information which describes several different items in addition to those items to be used, unless all relevant information is clearly identified. Assemble all data in completely indexed volume or volumes. Engrave the job title, and name, address, and phone numbers of the contractor on the front cover and on the spine. Incomplete O&M manuals will be returned to the contractor for corrections / additions.

1.9 RECORD DRAWINGS:

A. Maintain on a daily basis a complete set of "Red-Lined Drawings", reflecting an accurate record of all work including addendums, revisions, and changes. Indicate precise dimensioned locations of all concealed work and equipment, including concealed or embedded conduit, junction boxes, etc. Record all "Red-Lined Drawing" information on a set of full sized prints of the contract drawings.

B. Certify the "Red Lined Drawings" for correctness. Indicate on each drawing the name of the general and electrical contractors with signatures of each representative responsible for the work.

C. The electrical engineering design firm will create record (as-built) drawings from the certified red-lined drawings; however, the general and electrical contractors retain the responsibility for the accuracy of the record drawings.

1.10 WARRANTY:

A. Ensure that the electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes and is free from electrical defects. Without additional charge, replace or repair, to satisfaction of the owner's representative, except from ordinary wear and tear, any part of the installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance or as otherwise indicated in individual sections, but in no case less than one year. Warranty incandescent and fluorescent lamps only for a period of two months from the date of substantial completion.

B. Provide complete warranty information for each item including beginning of warranty period, duration of warranty, names, addresses, and telephone numbers and procedures for filling a claim and obtaining warranty services. Written warranties and guarantees are to be submitted separately as:

1. Originals bound in a binder clearly identified with the title, “WARRANTIES AND GUARANTEES,” the project name, the project number, and the Contractor’s business name.
2. Electronic documents in *.pdf format.

PART 2 – PRODUCTS

2.1 GENERAL:

A. All materials shall be new and shall bear the manufacturer's name, trade name, and the approved testing laboratory such as the UL label in every case where a standard has been established for that particular material. Used materials are acceptable only if specifically indicated on drawings.

2.2 SUBSTITUTION OF MATERIALS:

A. Provide only specified products or products approved by addendum. Substitutions will be considered if two copies of the proposal is received at the architect's/engineer's office eight (8) working days prior to the bid day. Include in the proposal the specified and proposed catalog numbers of the equipment under consideration and a catalog cut sheet(s) with pictorial and descriptive information. Certify that the equipment proposed is equal to that specified, that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents.

B. It is the responsibility of the contractor to make all substituted equipment comply with the intent of the contract documents and bear all cost associated with conflicts arising form the use of substituted equipment.

C. Provide samples if so required by the architect or engineer before or after bid day.

2.3 SPARE PARTS:

A. Provide spare parts as specified in Divisions 26, 27, and 28 sections. Deliver all spare parts to owner's representative prior to substantial completion.

PART 3 – EXECUTION

3.1 GENERAL:

A. Workmanship: Provide only first class workmanship from competent workers. Defective materials or workmanship will not be allowed on the project. Provide competent supervision for the work to be accomplished. Keep same foreman on the job, unless a change is authorized by the engineer.

B. Coordination: Prior to construction, layout electrical work and coordinate work with other trades. Sequence, coordinate, and integrate installation of materials and equipment for efficient flow of the work. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components. Coordinate with all utilities including power, communication, and data installations.

C. Provide cutting, drilling, channeling, etc. only as necessary for proper completion of the work. Do not cut structural members unless authorization is issued in writing by the architect/engineer.

D. Repairs: Repair damage to building, grounds, or utilities as a result of work under this contract at no additional cost to the owner.

E. Dimensioning: Electrical drawings indicate locations for electrical equipment only in their approximate location, unless specifically dimensioned. Do not scale electrical drawings for dimensional information. Refer to architectural drawings and shop drawings where applicable for locations of all electrical equipment. Field verify all dimension on the job site.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

G. Standards: Provide electrical installation in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

H. All workmen doing work of any nature on State of Utah projects must at all times carry their electrician's license with them and show it upon request. The acceptable ratio of apprentice to journeyman electricians on the job is 1:1.

3.2 REQUESTS FOR INFORMATION:

A. When it is clearly apparent that information is not adequately described in the construction documents or when a coordination problem exists, submit a request for information (RFI) through proper contractual channels. The electrical engineering design firm will provide a response through its contractual channel. Although verbal direction may be given to expedite changes, responses are not considered part of the contract documents until a change order has been issued and signed by the Owner or his designated representative. The Contractor shall bear all costs associated with proceeding on any change order that has not been approved by the Owner or his designated representative.

B. Any damages caused by construction delays due to frivolous RFI’s, will be born solely by the Contractor.

3.3 SAFETY PRECAUTIONS:

A. Provide all necessary guards or construction barriers and take all necessary precautions to insure the safety of life and property.

3.4 CLEAN:

A. Clean up all equipment, conduit, fittings, wire, packing cartons, plastic, and other debris that is a direct result of the installation of the work of this division, both during the execution, and at the conclusion, of the project. Keep the site clean and safe during the progress of the work. Clean fixtures, interior and exterior of all equipment, and raceways prior to final acceptance. Vacuum interior of all electrical panels and equipment. Correct any damaged equipment. Touch-up or repaint if necessary.

3.5 TEMPORARY POWER:

A. Make arrangements with the proper institution authority for all temporary electricity.

B. Provide temporary power, complete with metering and wiring for lighting and power outlets for construction tools and equipment. Report the initial meter reading to the owner/institution, or otherwise as may be directed.

C. Service shall be provided with a main disconnect and all 20 ampere receptacles protected by 20 amp GFI, single-pole breakers. No attempt is made herein to specify construction power requirements for equipment in detail. Provide all electrical equipment and wiring as required.

D. As soon as permanent power and metering is available, the temporary power supply shall be disconnected and removed from the project site.

E. All temporary wiring shall meet the requirements of NEC Article 590 and the State Industrial Commission.

3.6 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the owner. Any electrical service interruption will be coordinated at least 7 days in advance of the power shut-off. Include all costs for overtime work in bid. Coordinate all outages and proceed only after receiving authorization from the owner's representative. Keep all outages to an absolute minimum.

3.7 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. Lost or damaged materials will be replaced at no additional cost to owner. Do not store materials and apparatus in any public thoroughfare or in any area on the site where such storage would constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.8 EXCAVATING FOR ELECTRICAL WORK:

A. Verification: Prior to excavating, locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling. Observe all State and Local codes prior to excavating. Do not disturb walls, footings, and other structural members in any way.

B. Protection: Provide barricades, warning signs, and illumination to protect persons from injury at excavations. Provide temporary coverings and heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.

C. Coordination: Do not excavate for electrical work until the work is ready to proceed without delay.

D. Excavated Materials: Temporarily store excavated materials near excavation in manner which will not interfere with or damage excavation or other work. Dispose of and remove excavated materials which are either in excess of quantity needed for backfilling or do not comply with the requirements for backfill material.

E. Burial Depths: Burial depths must comply with NEC Section 300-5 (or State of Utah requirements, whichever is more stringent), unless noted otherwise on drawings.

F. Excavation Permits: Obtain all shut-down and excavation permits as may be required for proper completion of the work.

3.9 BACKFILL MATERIALS:

A. For buried conduits or cables (other than below slab-on-grade, or concrete-encased), provide 2" thickness of well-graded sand on all sides of conduits or cables.

B. For trench backfill to within 6" of final grade, provide soil material suitable for compacting to required densities.

C. For top 6" of excavation, provide top soil.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment:

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
2. Paved Areas, other than roadways: 90 percent for cohesive soils, 95 percent for cohesionless soils.

E. Where subsidence is observable at electrical work excavations during project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore surface to original condition.

3.10 ROOF PENETRATIONS:

A. Where raceways and/or cables penetrate roofing, provide 26 gauge galvanized iron roof jack, sized to fit tightly to raceway and/or cable for weather-tight seal, and with flange extending a minimum of 9" under roofing on all sides. Seal opening between raceway and roof jack with approved sealant. Coordinate all work with division 7.

3.11 FIRE PENETRATION SEALS:

A. Seal all raceway and/or cable penetrations through fire-rated floors, wall, and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. Provide penetration sealants and fittings of ratings to match the rating of the penetrated materials so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the NEC.

B. Sealant Systems: Provide sealants, wall wraps, partitions, caps, and other accessories complying with UL 1479 (ASTM E-814) from the following where applicable:

1. 3M Fire Barrier Sealing Penetration System
2. Chase Foam Fire Stop System
3. Thomas and Betts Flame Safe Fire Stop System
4. Nelson Fire Stop Products

C. Fittings: Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry wall, floor, slabs, and similar structures.

D. Install sealants and fittings in accordance with all manufacturer's written instructions.

3.12 LABELING:

A. Engraved black plastic laminated, with white-core labels, 1/16" thick, shall be permanently attached on both the interior and exterior the following electrical equipment:

1. Branch panels
2. Switchgear
3. Disconnect switches
4. Motor starter and controls junction boxes (power and auxiliary)
5. Push buttons
6. Thermal switches
7. Time switches
8. Motor control centers
9. Transformer
10. Similar equipment.
11. Lighting contactors and associated switches
12. Junction boxes larger than 4x4x1/2.

B. The labels shall have 1/4" high, engraved letters, such as EF-1, AC-1, Panel A, etc.

3.13 TESTS:

A. Notify engineer prior to all testing specified herein at least three business days prior to testing. Engineer shall observe all tests to insure the proper operation of the electrical system.

3.14 PROJECT FINALIZATION AND START-UP:

A. Upon completion of the work, have each factory representative and/or subcontractor assist in start-up and testing of their respective systems.

B. Have each representative give personal instructions on operating and maintenance of their equipment to the owner's maintenance and/or operation personnel.

C. Have representatives certify each system with a written statement indicating that they have performed start-up and final check out of their respective systems.

3.15 FINAL REVIEW:

A. Have the project foreman accompany their reviewing parties and remove coverplates, panel covers, access panels, etc. as requested, to allow review of the entire electrical system.

END OF SECTION 260001

SECTION 260070

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connections for equipment include all final electrical connections for all equipment having electrical requirements including, but not necessarily limited to the following:

1. Equipment specified under all divisions of the contract. Refer to other divisions for specific electrical requirements.
2. Owner-furnished equipment

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SHOP DRAWINGS: Not required.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide all materials for electrical connections including, but not necessarily limited to the following:

1. Raceways
2. Fittings
3. Conductors
4. Cords
5. Cord caps
6. Wiring devices
7. Pressure connectors
8. Lugs (CU-AL)
9. Electrical insulating tape
10. Heat-shrinkable tubing
11. Cable ties
12. Wire nuts
13. Other items and accessories as required.

B. Crimp on or slip-on type splicing materials designed to be used without wire stripping are not

acceptable.

C. Power Distribution Blocks: Provide Square D Type LB or Equivalent.

D. Refer to other Division 26, 27, and 28 Sections for specification of electrical materials as applicable.

PART 3 – EXECUTION

3.1 GENERAL:

A. Make electrical connections in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONNECTIONS:

A. Permanently Installed Fixed Equipment:

1. Install conductors in flexible conduit from junction box to equipment control panel or connection point.
2. Where such installations are subject to moisture, install in liquid-tight flexible conduit.

B. Movable equipment:

1. Provide wiring devices, cord caps, and multi-conductor cables as required.

C. Other methods as required by the NEC and/or as required by special equipment or field conditions.

D. Power Distribution Blocks: Unless noted otherwise on drawings, provide power distribution blocks only for tapping of feeders and branch circuits. Locate in junction box or gutter in NEMA ratings to suit application.

3.3 MANUFACTURER'S INSTRUCTIONS:

A. Obtain manufacturer's instruction and wiring diagram regarding electrical connections of each piece of equipment and provide connections in accordance therewith.

3.4 VERIFICATION OF LOAD CHARACTERISTICS:

A. Verify electrical load characteristics of all equipment prior to rough-in. Review respective shop drawings of all other Divisions and Owner's equipment manuals. Report any variances from electrical characteristics noted in the contract documents to the Architect/Engineer prior to rough-in.

B. Value of rough-in work, electrical equipment, etc. installed and/or purchased by the contractor not meeting equipment requirements shall be credited back to the owner.

END OF SECTION 260070

SECTION 260072

ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.
3. Construction requirements for concrete bases.

1.3 DEFINITIONS:

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS:

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE:

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS:

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Available Manufacturers:
   a. Cooper B-Line; a division of Cooper Industries.
   b. ERICO International Corporation.
   c. Allied Support Systems; Power-Strut Unit.
   d. GS Metals Corp.
   e. Michigan Hanger Co., Inc.; O-Strut Div.
   f. National Pipe Hanger Corp.
   g. Thomas & Betts Corporation.
   h. Unistrut; Tyco International, Ltd.
   i. Wesanco, Inc.
2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Verify suitability of fasteners in subparagraph below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers:
      1) Hilti, Inc.
      2) ITW Construction Products.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co. Inc.
3. In the following subparagraph, use stainless steel anchors in corrosive environments.
4. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers:
      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
6. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
7. Toggle Bolts: All-steel springhead type.
8. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS:

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system

components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Available Manufacturers:
   a. Amber/Booth Company, Inc.
   b. Loos & Co., Inc.
   c. Mason Industries, Inc.
2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES:

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 – EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for raceways as within 12 inches of coupling, fitting, and box, at each 90 degrees bend, minimum of two supports per ten foot run. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps, or as otherwise required by an agency acceptable to authorities having jurisdiction.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION:

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Do not drill or core cut holes for anchors or use powder-activated fasteners in post-tension slabs, joists, and beams.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS:

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES:

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.

2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 5000-psi (34.5-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS:

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 260072

SECTION 260080

ELECTRICAL DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical demolition work is indicated by drawings.

B. Electrical demolition items are shown to give a basic description of the extent of demolition work, but may not be inclusive.

C. Do not assume that the electrical drawings reflect as-built conditions. Visit and observe the project prior to submitting bid and determine extent of electrical demolition work.

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 260001 - Electrical General Provisions as applicable.

PART 2 – PRODUCTS - Not Used.

PART 3 – EXECUTION

3.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Cutting work of other contractors shall be done only with the consent of that contractor. Cutting of structural members is not permitted. Repair damage to building and equipment as a result of electrical demolition work under this contract at no additional cost to owner.

B. Obtain permission from the architect before penetrating any ceiling, floor, and wall surfaces.

3.2 METHODS:

A. Disconnect and remove any/all fixtures, devices, equipment, etc. required for proper completion of the work whether shown or not.

B. Relocate, rewire, and/or reconnect any/all fixtures, devices, equipment, etc. that for any reason obstructs construction.

C. Maintain circuit integrity and continuity of all existing circuits/feeders, and systems that interfere with or are interrupted by remodel work, unless those circuits/feeders are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduits, etc. as required.

D. Leave all existing fixtures, devices, equipment, etc. In portions of the building not being remodeled, in working condition.

E. Remove and dispose of all raceways, conductors, boxes, devices, equipment, etc., that are not to be reused. Terminate at accessible junction box by providing proper knockout closure, tape conductors, and label as "spare" with circuit no., Zone no., or other characteristic identifying source.

F. Existing raceways may be reused, if in place, where in compliance with the contract documents and the National Electrical Code. Upgrade and/or provide new conduit supports where necessary for all raceways being reused. Insure integrity of existing raceways before re-use.

G. Return to owner all light fixtures which are to be removed. Dispose of all light fixtures if so directed by owner in accordance with local environmental laws and policies. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, re-lamped, and installed as indicated. When storing fixtures for reuse, store in area and/or provide protective covering that will keep construction dust and materials off fixtures.

H. Completely remove all telephone or data cables which are to be removed back to source or as directed by owner.

I. Disconnect and remove all sound system equipment including speakers, amplifiers, etc. And return to owner. Completely remove and dispose of all associated conduit and wire.

3.3 PATCHING AND REPAIR:

A. Finished Surfaces: The electrical contractor is responsible for patching and repair of all existing interior surfaces pertaining to the installation of work under this Division, unless specifically noted elsewhere in the contract documents. Where patching and repair is necessary, surfaces shall be finished (painted, etc.) to match the adjacent materials, finished, and colors. Requirements of other Divisions such as Division 9 - finishes shall apply.

B. Hard Surfaces: Whenever excavation or trenching is required for the installation of electrical work, it shall be the responsibly of the electrical contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc. Requirements of other Divisions such as Division 2 – Existing Conditions shall apply.

3.4 CONCEALING:

A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas.

END OF SECTION 260080

SECTION 260110

CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conduit raceways.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the followings:

1. Rigid Metal Conduit
2. Intermediate Metal Conduit
3. Electrical Metallic Tubing
4. Flexible Metal Conduit
5. Liquid-tight Flexible Metal Conduit
6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable. Provide conduit raceway installation in accordance with recommendations of the American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest edition.

B. Manufacturers: Firms regularly engaged in the manufacture of raceway of types and sizes required, whose products have been in satisfactory service for not less than three (3) years.

C. Shop Drawings: Not required.

PART 2 – PRODUCTS

2.1 CONDUITS:

A. Rigid Metal Conduit (RMC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in accordance with Federal Specification WW-C-0581 and ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in accordance with Federal Specification WW-C-581.

C. Electric Metallic Tubing (EMT): Provide electric metal tubing in accordance with Federal Specification WW-C-563 and ANSI C80.3.

D. Flexible Metal Conduit: Provide zinc-coated, flexible metal conduit in accordance with Federal Specification WW-C-566.

E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit, constructed of single strip, flexible continuous, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid-tight jacket of flexible Polyvinyl Chloride (PVC).

F. Rigid Non-Metallic Conduit: Provide rigid non-metallic conduit (PVC) in accordance with ANSI/NEMA TC 2, Type 1 for concrete encasement, Type 2 for direct burial.

2.2 FITTINGS:

A. Rigid Metal Conduit and Intermediate Metal Conduit: Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

B. Electric Metallic Tubing: Provide insulated throat, non-indenter, set screw, malleable steel fittings. Screws must have a full set. Provide concrete-tight compression-type fittings in suspended slabs. All EMT fittings shall be fabricated from steel. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable. Install OZ Type B bushings on conduits 1" and larger.

C. Flexible Metal Conduit: Provide flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 1, and Style A. Commercial "greenfield" not less than 1/2" diameter or as otherwise specified on drawings is acceptable.

D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 3, Style G.

E. Non-Metallic Conduit: Provide non-metallic conduit fittings (PVC) in accordance with ANSI/NEMA TC 3 to match conduit types and materials.

F. Expansion Fittings: OZ Type AX, or equivalent to suit application.

G. Sealing Bushings: Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ Type CSB internal sealing bushings.

H. Cable Supports: Provide OZ cable supports for vertical risers, type as required by application.

2.3 SIZES:

A. Provide conduits in sizes as indicated in contract documents or as otherwise specified herein, but not less than 3/4".

PART 3 – EXECUTION

3.1 GENERAL:

A. Install raceway and accessories in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 LOCATIONS:

A. Rigid Metal Conduit and Fittings: Use for conduit bends greater than 22 degrees where buried below grade or slab on grade. Install RMC where raceway passes vertically through slab-on-grade. Where raceways penetrate building, manholes, or vault walls and floors below grade, provide RMC for a minimum distance of 10' on the exterior side of the floor or wall. Use RMC for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.

B. Intermediate Metal Conduit and Fittings: Use for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.

C. Electric Metal Tubing and Fittings: Use for above-grade feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Install in suspended slabs subject to local code requirements and fire rating considerations.

D. Flexible Metal Conduit and Fittings: Use as whips for lighting fixtures, fixed equipment where not exposed to weather of moisture, other devices where required by NEC, and as requested by the Engineer. Maximum length not to exceed 6', unless specifically approved by the Electrical Engineer.

E. Liquid-Tight Flexible Metal Conduit and Fittings: Use for connection to motor terminal boxes, fixed equipment where subject to moisture or weather, and other equipment subject to movement or vibration. Maximum length not to exceed 6', unless specified otherwise.

F. Rigid Non-Metallic Conduit and Fittings: Use for below-grade service entrances, feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Do not use above grade.

3.3 METHODS:

A. Maintain a minimum of 12" clearance between steam or hot water lines or other hot surfaces. Where such clearance is impractical, insulate conduit with approved materials.

B. Install conduits parallel with or at right angles to lines of the structure. Route conduits symmetrically where possible.

C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.

D. Precaution shall be exercised to prevent accumulation of water, dirt or concrete in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.

E. Any conduit which pierces airtight spaces or plenums shall be sealed to prevent air leakage with mastic acceptable to the Architect.

3.4 CONCEALING:

A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas. In equipment rooms, if lighting raceways are run exposed, installation shall not be done

until piping and duct work layout has been determined in order that lighting boxes may be located so as to avoid being covered by overhead ducts and piping. If lighting raceways in equipment rooms are concealed in the structural ceiling slab, after mechanical work is complete, exposed conduit extensions shall be run to locate lighting fixtures where they are not obscured by work of other trades.

3.5 BURIED CONDUITS:

A. Comply with all burial depths as defined in NEC Section 300-5. Bury all conduits at least 24" below grade, unless specifically indicated otherwise on drawings. Provide magnetic 6" wide “Yellow Warning" ribbon 12" directly above conduit and 6" below finished grade measured from the top of the conduit or duct bank. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single marker.

B. Slope all conduits toward manholes or pull boxes for proper drainage. Use weep holes. Gravel drainage pockets are not permitted.

C. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.

D. Under Concrete Slab on Grade: Horizontal conduit must be installed a minimum of 2” below the bottom of the concrete slab. Conduits should not be installed in concrete slabs.

E. Where conduits are extended for future use, cap and clearly mark.

3.6 ELECTRICAL CONTINUITY:

A. Provide electrically continuous conduit systems throughout.

3.7 FIELD CUTS AND THREADS:

A. Cut all conduits square. Remove all sharp or rough edges and ream all burrs, inside and outside. Provide clean sharp threads on RMC and IMC.

B. Engage at least five full threads on all RMC and IMC fittings. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.8 CONDUIT ENDS:

A. Cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

3.9 SPARE CONDUITS:

A. Provide five (5) 3/4" empty conduits from panel stubbed into accessible ceiling space and five (5) 3/4" conduits into accessible floor space. When floor is not accessible, provide six (6) 3/4" empty conduits from panel stubbed into accessible ceiling space. Cap and label all conduits.

B. Install a 200 lb. polypropylene pull cord in each empty conduit run.

3.10 ROCKY MOUNTAIN POWER RACEWAY METHODS:

A. Comply with all requirement of the current six state ESR manual, the entire document can be

found at the following web address for downloading and printing:
http://www.rockymountainpower.net/esr

B. The contractor shall provide all conduit systems for the required electrical utility work; raceway shall be PVC or RMC. All elbows shall be long-radius PVC, RMC, or fiberglass elbows complying with all ESR requirements. Sleeve conduits when conduit extends vertically through a paved surface. Provide 500 lb flat pull line or poly rope within each conduit. Proof all conduits with an 80% diameter mandrel witnessed by the Utility representative.

C. The contractor shall provide trenching, boring, backfill, compactions, and surface repair.

D. The contractor shall provide pre-case concrete pad/vaults for utility provided transformers as required.

E. The contractor shall provide concrete pads for utility provided transformers as required.

F. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

3.11 HAZARDOUS LOCATIONS:

A. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

3.12 CLEANING:

A. Pull mandrel and swab through all conduits before installing conductors.

END OF SECTION 260110

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SECTION 260120

CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conductors and cables.

1.2 DESCRIPTION OF WORK:

A. This section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors.
2. MC Flexible Metal Clad Copper Cables.
3. Flexible Cords.

C. Applications for conductors and cables required for project include:

1. Electrical service.
2. Feeders.
3. Branch Circuits.

1.3 SUBMITTALS:

A. Product Data: For each type of conductor and/or cable indicated.

B. Field Quality-Control Test Reports: From Contractor. Refer to Section 260001 – General Electrical Provisions.

1.4 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Manufacturers: In other Part 2 articles where subparagraph titles below introduce lists, provide

products by the manufacturer specified, subject to compliance with requirements.

B. Ambient Conditions: Conductors used for branch circuits in areas where the ambient conditions exceed 30 degree C. shall be provided with insulation approved for that temperature.

C. Wire Sizes: As indicated on electrical drawings or as specified herein, but in no case less than No. 12 AWG.

2.2 COPPER CONDUCTORS:

A. Manufacturers:

1. Cerro Wire & Cable Company.
2. General Cable Technologies Corporation.
3. Encore Wire Corporation.
4. Southwire Incorporated.

B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.

C. References and Ratings:

1. ICEA S-95-658 / NEMA WC70.
2. ASTM.
3. UL Standard 83.
4. UL Standard 1063 (MTW).
5. Federal Specification J-C-30B.
6. NEC.

D. Conductor Material: Copper.

E. Stranding: Solid conductor for No. 12 AWG, stranded for No. 10 AWG and larger.

F. Conductor Insulation Types: Thermoplastic-insulated, Type THHN / THWN-2.

2.3 MC FLEXIBLE METAL CLAD COPPER CABLES:

A. Manufacturers:

1. AFC Cable Systems, Inc.

B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.

C. References and Ratings:

1. UL 83, 1479, 1569, 1581, File Reference E80042.
2. NEC 230-43, 300-22(c), 318, 321, 334, 518, 520, 530, 645.
3. Federal Specifications J-C-30B.
4. Meets all applicable OSHA and HUD requirements.
5. May be surface-mounted or embedded in plaster.
6. UL rated for Cable Tray and Environmental Air-Handling Space installation; 1, 2 and 3-hour through-penetration Fire Wall rated.

D. Conductor Material: Copper.

E. Stranding: Solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

F. Conductor Insulation Types: Type THHN.

G. Armor: Galvanized steel.

H. Assembly Covering: Mylar Tape.

I. Grounding: Insulated green grounding conductor.

2.4 FLEXIBLE CORDS:

A. Manufacturers:

1. Cerro Wire & Cable Company.
2. General Cable Technologies Corporation.
3. Encore Wire Corporation.
4. Southwire Incorporated.

B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.

C. References and Ratings:

1. ASTM.
2. ICEA.
3. UL 62.
4. Pendant or portable.
5. Damp locations.
6. 600 Volts.
7. NEC Article 400.

D. Conductor Material: Copper.

E. Stranding: Class K, flexible stranded conductor.

F. Conductor Insulation Types: Heat- and moisture-resistant TPE insulation.

G. Fillers and Wrapping: Non-wicking polypropylene fillers, with tissue-paper separator wrapped around the assembly.

H. Outer Jacket: Black-colored, heat-, moisture-, and oil-resistant TPE jacket.

I. Grounding: Insulated green grounding conductor.

J. Cord Type: SO, hard-usage.

2.5 CONNECTORS AND SPLICES:

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Splices for wire sizes #10 and smaller shall be screw-on type similar to scotch or ideal wing nut connectors. Crimp-on splices designed to be used without wire stripping are not acceptable.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install conductors, cables, and accessories as indicated, in compliance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standards of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONDUCTOR AND CABLE APPLICATIONS:

A. Service Entrance: As indicated on the electrical drawings.

A. Feeders: As indicated on the electrical drawings with the exception that all emergency feeders that are not installed in space that are fully protected by an approved automatic fire suppression system shall be MI Mineral Insulated Copper Cables; this includes locations such interstitial spaces above fire suppression system sprinklers.

B. Branch Circuits:

1. Exposed, including in crawlspaces: Copper conductors in raceway. In finished ceiling areas, conduits shall be painted to match the surrounding surface.
2. Concealed in gypsum board ceilings, walls, and partitions: Copper conductors in homerun raceways from electrical panelboards to first outlet box; MC flexible metal clad copper cables are allowed for connection of wiring devices, light fixtures, and equipment at load end and in dry and concealed locations only. MC cables are not allowed in CMU or concrete walls. Maximum distance on any one MC cable run is limited to **30 feet MAX** then it must transition to EMT via a junction box installed in an accessible location.

3. Concealed in concrete and below slabs-on-grade: Copper conductors in raceway.

C. Cord Drops, Reels, and Portable Appliance Connections: Flexible cord.

3.3 INSTALLATION:

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. When raceway is not required, install concealed cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.

E. Support cables according to other applicable specification sections.

F. Seal around cables penetrating fire-rated elements to comply with applicable fire stop specification sections.

G. Color Coding: Color code secondary service, feeder, and branch circuit conductors. Colors shall remain consistent throughout the project and shall match existing coding system where applicable.

1. Conductor sizes No. 6 AWG and smaller: Colored insulation.
2. Conductors sizes No. 4 AWG and larger: 2 inch (51 mm) band of Colored adhesive marking tape applied at all terminations, junction boxes, and pull boxes.
3. Branch circuit switched-legs and travelers: Colored insulation (in colors other than those indicated below).
4. Color-code 120/208V system conductors:
   A. Phase A: Black.
   B. Phase B: Red.
   C. Phase C: Blue.
   D. Neutral A: White with Black stripe.
   E. Neutral B: White with Red stripe.
   F. Neutral C: White with Blue stripe.
   G. Neutral (Shared when allowed): White
   H. Ground: Green.
   I. Isolated Ground: Green with yellow tracer.

3.4 HOMERUN CIRCUITS:

A. Homerun circuits may be combined in common conduits at the option of the contractor in compliance with the following:

1. Three-Phase Installations: Not more than three single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a, b, or c).
2. Single-Phase Installations: Not more than two single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a or b).

3.5 NEUTRAL CONDUCTORS:

A. LINE-TO-NEUTRAL BRANCH CIRCUITS: Provide a dedicated neutral for each line-to-neutral branch circuit. Size the neutral conductor the same as the phase conductor. In each outlet or junction box containing multiple neutral conductors, tag each neutral to identify which circuit it serves.

3.6 VOLTAGE DROP:

A. Provide branch circuit conductors in sizes such that voltage drop for branch circuits do not exceed 3 percent at the farthest outlet. Provide service, feeder, and branch circuit conductors so that the voltage drop on the entire electrical system does not exceed 5 percent at the farthest outlet. This shall be strictly followed regardless of the conductor sizes indicated on the electrical drawings. Increase conductor sizes (and conduits where necessary to comply with NEC conduit fill requirements) as necessary to accommodate this requirement. Calculations shall be based on the following:

1. Lighting Branch Circuits: Connected load plus 25% spare.
2. Appliance and Equipment Branch Circuits: Nameplate or NEC required load.
3. 120V Convenience Outlet Branch Circuits: 12 amps minimum, but in no case less than NEC loading requirements. Use the following schedule as an example:

Distance (feet)	Wire Size (AWG)
0-80	#12
81-125	#10
126-200	#8

201-320 #6

3.7 CONNECTIONS:

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack. Use pig tails when wiring outlets.

3.8 FIELD QUALITY CONTROL:

A. Testing: Perform the following field quality-control testing:

1. Visual and Mechanical Inspection:
   A. Inspect cables for physical damage and proper connection in accordance with the electrical construction documents.
   B. Test cable mechanical connections to manufacturer’s recommended values with a calibrated torque wrench.
   C. Check cable color coding for compliance with electrical specifications.
2. Electrical Tests:
   A. Perform insulation resistance test on each conductors for feeders 100 amps and greater with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   B. Perform continuity test to insure proper cable connection.
3. Test Values:
   A. Minimum insulation resistance values shall not be less than two megaohms.

B. Test Reports: Prepare a written report and submit to the Electrical Engineer at the completion of the project. The report shall include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260120

SECTION 260135

ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical boxes and fittings.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical boxes and fittings work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Floor Boxes
5. Conduit Bodies
6. Bushings
7. Locknuts
8. Knockout Closures
9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable.

B. Manufacturers: Firms regularly engaged in the manufacturer of boxes and fittings required, whose products have been in satisfactory service for not less than three years.

C. Shop Drawings: Submit shop drawings on floor boxes only where required.

PART 2 – PRODUCTS

2.1 INTERIOR OUTLET BOXES:

A. General: Provide one piece, galvanized or cadmium-plated, flat-rolled, sheet steel interior outlet boxes of types, shapes, and sizes to suit respective location and installation. Construct with stamped knockouts on back and sides and with threaded screw holes. Provide corrosion-resistant screws for securing boxes, covers, and wiring devices. Size all junction boxes in accordance with NEC Table 314.16(A), with a minimum box size of 4" x 4" x 1-1/2". Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16". Gangable boxes shall not be used.

B. Switch, Telephone, and Receptacle Outlets: Provide outlet boxes not less than 4" square, with adapting tile or plaster covers where necessary to set flush with finished surfaces. Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Gang boxes shall be used where more than one switch or device is located at one point. Sectional Boxes are not acceptable. In masonry walls where tile or plaster ring cannot be used, install a single-gang 3-1/2" deep box minimum, unless otherwise noted. Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".

C. Lighting Outlets:

1. Lay-in Grid: Outlets for recessed fixtures in acoustical tile ceilings shall be located to center on a single tile or at the intersection of four tiles.
2. Surface-mounted: Provide 4" square octagonal outlet boxes for surface-mounted, ceiling fixture outlets. Mount each box independently of the conduit on standard 3/8" stud or approved box hangar where applicable. Include backing and supports as required to carry 200 lbs. Where three or more raceway entrances are made, use a minimum box depth of 2-1/8".

2.2 WEATHERPROOF OUTLET BOXES:

A. Provide corrosion-resistant, cast-metal weatherproof outlet boxes, of types, shapes, and sizes, with threaded conduit ends, cast metal coverplates with spring-hinged waterproof caps, face plate gaskets, and corrosion-resistant fasteners.

2.3 JUNCTION AND PULL BOXES:

A. Provide code-gauge sheet steel junction and pull boxes, with removable screw-on covers and welded seams, of types, shapes, and sizes to suit each respective location and installation. Size all junction and pull boxes in accordance with NEC 314.28. Provide stainless steel nuts, bolts, screws, and washer.

2.4 FLOOR BOXES:

A. Provide steel or PVC, weatherproof, concrete-tight floor boxes of types, shapes, and sizes to suit each respective location and installation. Where multi-service floor boxes are indicated, provide floor boxes sized to accommodate wiring devices and communication outlets shown on drawings. Construct floor boxes with fully adjustable leveling screws, and knockouts as required to accommodate specified conduits.

B. Provide floor boxes from the following manufacturers:

1. Bell Electric
2. Crouse-Hinds
3. Hubbell
4. Steel City
5. Thomas&Betts
6. Wiremold

2.5 CONDUIT BODIES:

A. Provide galvanized, cast-metal conduit bodies of type, shapes, and sizes to suit respective locations and installation. Construct with threaded conduit entrance ends and removable covers. Provide corrosion-resistant screws.

B. Aluminum boxes and fitting shall not be permitted.

2.6 CONDUIT CONNECTIONS:

A. Box connectors 3/4" and larger shall be insulated, throat-type or equal type plastic bushings. Provide double locknuts and insulating plastic bushings for RMC and IMC terminating at panels and boxes.

B. Where RMC penetrates building, manholes, or vault walls and floors below grade, provide sealing bushings with external membrane clamps as applicable. Provide segmented internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway. Where RMC terminates in manhole, vault, or pull box, provide insulated grounding bushings. Also see Section 260135 – Electrical Boxes and Fittings.

C. Install OZ type "B" connectors for all conduits 1" and larger.

D. Provide cable supports in all vertical risers in accordance with NEC 300-19.

2.7 EXPANSION FITTINGS:

A. Provide expansion joint fittings in all conduit runs crossing structural expansion joints, whether above-grade, in slab-on-grade, or in suspended slabs. Provide OZ type "AX" or approved equivalent, size to the raceway.

2.8 ACCESSORIES:

A. Provide all accessories including, but not necessarily limited to, bushings, knockout closures, locknuts, offset connectors, etc. of types, shapes, and sizes to suit respective locations and installation. Construct of corrosion-resistant steel.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install electrical boxes and fittings in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 METHODS:

A. Where outlet boxes are subject to weather or moisture, install weatherproof outlet boxes.

B. Remove knockouts only for entering conduits. Provide knockout closures to cap unused knockout holes where blanks are mistakenly removed.

C. Do not use condulets in place of elbows or junction boxes. Condulets in sizes 2" or larger shall not be used, unless specifically approved by the electrical engineer.

D. Install boxes and conduit bodies in readily accessible locations. Install recessed boxes with faces of boxes or rings flush with finished surfaces. Seal all openings between outlet box and adjacent surfaces with plaster, grout, or similar suitable material.

E. For stud construction, install boxes with rigid supports using metal bar hangers, or 2" X 4", 1" X 6" wood bridging between studs with screws. Welding or nailing boxes directly to metal joist

and studs is not acceptable. Boxes set opposite in common wall shall have at least 10" of conduit between them. Securely fasten outlet boxes to structural surfaces to which attached.

F. For concrete or masonry construction, solidly embed electrical boxes in concrete and masonry. Provide box supports as required to keep outlet boxes flush with finished surfaces.

G. Coordinate location of all outlet boxes with millwork, back splashes, tackboards, etc.

H. Install junction boxes or condulets in conduit runs as required at 100 foot maximum intervals on long runs. This shall apply to concrete junction boxes in grade and junction boxes within the building.

I. Provide electrical connections for installed boxes.

3.3 IDENTIFICATION:

A. Mark circuit number on exterior side of junction boxes located in ceilings such that circuits numbers are readily identifiable. For outlet boxes in wall, mark circuit numbers on interior sides of outlet boxes.

B. Identification labels shall be as follows:

Normal Power Black with White letters

END OF SECTION 260135

SECTION 260140

WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to wiring devices.

1.2 DESCRIPTION OF WORK:

A. Extent of wiring device work is indicated by drawings and schedules.

B. Types of electrical wiring devices in this section include the following:

1. Toggle Switches
2. Receptacles
3. Special Purpose Outlets

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 26 0001 – Electrical General Provisions as applicable.

B. SHOP DRAWINGS:

1. Submit manufacturer's data on all electrical wiring devices.
2. Where occupancy sensors are required, provide scaled drawing showing manufacturer's recommended locations.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA standards Pub No. WD 1; nylon construction, 20 amp rating minimum.

B. Provide wiring devices in colors selected by Architect/Engineer. Provide red receptacle outlets where devices are circuited to standby power.

2.2 TOGGLE SWITCHES:

A. Provide toggle switches from one of the following manufacturers (Fed-Spec):

Manufacturer	1-Pole	3-Way	4-Way	W/Pilot

Hubbell	HBL1221	1223	1224	1221-PL
Pass & Seymour	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	1221	1222	1223	1221-PLR
Cooper	2221	2223	2224	2221-PL
Bryant	4901	4903	4904	4901-PL

B. Abbreviations are defined as follows:

1. 1-Pole - Single-Pole Toggle Switch
2. 3-Way - Three-Way Toggle Switch
3. 4-Way - Four-Way Toggle Switch
4. W/Pilot - Single-Pole Toggle Switch with Pilot Light

C. Must be back and side wired, and have color-coded covers, Brass terminal screws, back wire ground clamp, and self-grounding clip.

2.3 RECEPTACLES:

A. Provide duplex receptacles from one of the following manufacturers:

Manufacturer	CO	GFCI	IG
Hubbell	5362	GF5362	5362IG
Pass & Seymour	5362	2091-S	IG6300
Leviton	5362	8899	5362-IG
Cooper	5362	VGF20	IG5362

B. Where indicated on the electrical drawings and/or as otherwise required by the NEC, provide heavy-duty, straight-blade, tamper-resistant, specification-grade, 20-amp duplex receptacles from one of the following manufacturers:

Basis-of-Design Manufacturer	CO	GFCI
Hubbell	HBL5362_TR	GFTRST20_

Equivalent products from Pass & Seymour and Cooper are also acceptable.

C. Where duplex receptacles are shown with an “H” subscript on the electrical drawings and/or as otherwise required by the NEC, provide heavy-duty, straight-blade, tamper-resistant, specification-grade, hospital-grade, 20-amp duplex receptacles from one of the following manufactures:

Basis-of-Design Manufacturer	CO	GFCI
Hubbell	8300_TRA	GFTRST83_

Equivalent products from Pass & Seymour and Cooper are also acceptable.

D. Where duplex receptacles are shown with an “USB” subscript on the electrical drawings, provide USB-charger (Types A & C), straight-blade, tamper-resistant, specification-grade, hospital-grade, 20-amp duplex receptacle from one of the following manufactures:

Basis-of-Design Manufacturer	CO
Hubbell	USB8300AC5_

Equivalent products from Pass & Seymour and Cooper are also acceptable.

E. Abbreviations are defined as follows:

1. CO- Convenience Outlet Duplex Receptacle
2. GFCI- Ground Fault Circuit Interrupter duplex Receptacle
3. IG- Isolated Ground Duplex Receptacle

F. Must have one-piece Brass back strap and back wire grounding clamp (Does not apply to GCFI or isolated ground).

2.4 SPECIAL PURPOSE OUTLETS:

A. Provide special purpose outlets of voltage and ampere ratings, and NEMA configurations to suit respective application. Refer to drawings for NEMA configuration. Provide special purpose outlets in amperages at least as large as the overcurrent protective device from which they are served.

2.5 CORD CAPS AND CONNECTORS:

A. Provide cord caps and connectors of voltage and ampere ratings, and NEMA configurations which mate and match with outlets specified as required for final connections for equipment. Provide cord caps and connectors of one of the following:

1. Hubbell
2. Pass & Seymour
3. Leviton
4. Cooper
5. Bryant

2.6 COVERPLATES:

A. Wall Plates: Provide coverplates for all wiring devices. In all finished areas, provide stainless steel coverplates. Provide ganged coverplates for all switches and/or dimmers. Provide pre-marked coverplates for special purpose outlet indicating voltage, amperages, and phase. Provide raised stamped, galvanized, steel plates in all unfinished areas. Provide weather-proof coverplates for outlets exposed to weather and moisture.

B. Weather-Protecting Device Enclosure: Where required for compliance with NEC 410-67 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

1. See Drawings.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install wiring devices and accessories in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to insure that products fulfill requirements.

3.2 METHODS:

A. Install wiring devices only in electrical boxes which are clean and free from excess building materials, dirt, and debris. Do not install wiring devices until painting work is completed.

B. Replace receptacles and/or coverplates which are damaged, stained, or burned.

3.3 GFCI RECEPTACLES:

A. Provide separate neutral conductor from panel to each GFCI receptacle circuits.

B. Install GFCI receptacles for all receptacles installed in restrooms, outdoors, or within six feet of any sink. All receptacles in kitchens shall be GCFI protected.

C. Do not wire standard receptacles on the load side of GFCI receptacle - Install GFCI receptacles.

3.4 GROUNDING:

A. Provide electrical continuous, tight, grounding connections for wiring devices.

3.5 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

3.6 IDENTIFICATION:

A. All devices shall be identified on the cover plate with the panel board name and the circuit number by a black on clear adhesive label.

B. All devices fed from the Generator shall be identified on the cover plate with the panel board name and the circuit number by a red on clear adhesive label.

C. In each outlet, tag each wire to identify the circuit it serves.

END OF SECTION 260140

SECTION 260155

MOTOR STARTERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to motor starters.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Type of motor starters in this section include the following:

1. Fractional Horsepower Manual Starters
2. Non-Reversing Magnetic Starters
3. Combination Non-Reversing Magnetic Starters

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Shop Drawings: Submit manufacturer's data and dimensional details on motor starters including voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Manufacturers: Subject to compliance with all requirements, provide products of on of the following:

1. Allen Bradley
2. General Electric
3. Siemens
4. Square D

B. Maintenance, Stock, Fuses: For types and ratings required, furnish additional fuses,

amounting to one unit for every 10 installed units, but not less than 3 units of each, for both power and control circuit fuses.

2.2 THERMAL OVERLOAD UNITS:

A. Provide metal alloy, thermal overload units for all motor starters. Size to actual running full load current, not to motor plate current, after air and water balancing are completed.

2.3 FRACTIONAL HORSEPOWER MANUAL STARTERS:

A. Provide fractional horsepower manual starters for single-phase fractional horsepower motors up to and including 1 horsepower, equivalent to Square D Class 2510, Type F, of types, sizes, and electrical characteristics required to suit applications or as otherwise indicated on drawings. Provide NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage starter, with thermal overload units, red pilot light, and toggle operator with handle guard/lock-off. Provide ANSI/NEMA ICS 6, Type 1 enclosures, or where subject to weather or moisture, Type 3R.

2.4 NON-REVERSING MAGNETIC STARTERS:

A. Provide non-reversing magnetic starters equivalent to Square D Class 8536, Type S, of types, sizes, and electrical characteristics as required to suit applications or as otherwise indicated on drawings. Provide NEMA ICS 2, AC general-purpose Class A magnetic starter for induction motors. Provide encapsulated coil with operating voltage compatible with control system (coordinate with Divisions 21, 22, and 23). Provide totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring. Provide straight-through wiring with all terminals clearly marked. Provide NEMA ICS, melting alloy, interchangeable, overload relays with one-piece thermal unit construction and under voltage protection in all phases. Provide replaceable overload relay control circuit contacts. Thermal units shall be required for starter to operate. Provide NEMA ICS 2, 2 each normally open and closed, field convertible, auxiliary contacts in addition to seal-in contact. Provide rotary-type, hand-off-auto and reset switches, recessed pushbutton control. Provide red pilot light. Provide control power transformer in each motor starter with fused primary and secondary. Provide each magnetic starter with integral phase failure protection that will protect against phase loss, phase unbalance, phase reversal, and undervoltage. Provide ANSI/NEMA ICS 6, Type 1 enclosures, or where subject to weather or moisture, Type 3R.

2.5 COMBINATION NON-REVERSING MAGNETIC STARTERS:

A. Provide combination, non-reversing magnetic starters equivalent to Square D 8538, Type S (non-fusible and fusible disconnect switch type) and Square D 8539, Type S (motor circuit protector type), of types, sizes, and electrical characteristics as required to suit applications or as otherwise indicated on drawings. Provide non-reversing magnetic starters and/or two-speed non-reversing magnetic starters with features as noted above in the descriptions for "NON-REVERSING MAGNETIC STARTERS" and "TWO-SPEED NON-REVERSING MAGNETIC STARTERS".

B. Where Combination Magnetic Starter/Motor Circuit Protector switches are specified, provide NEMA AB 1, circuit breakers with integral instantaneous magnetic trip in each pole. Provide circuit breakers with externally operable handles that give positive visual indication of ON-OFF positions with red and black color coding.

C. Where Combination Magnetic Starter/Nonfusible Disconnect Switches are specified, provide NEMA KS 1, enclosed knife switch with externally operable handle and visible blades. Provide disconnects with externally operable handles that give positive visual indication of ON-OFF positions with red and black color coding.

D. Where Combination Magnetic Starter/Fusible Disconnect Switches are specified, provide NEMA KS 1, enclosed knife switch with externally operable handle and visible blades. Provide switches with Fuse clips to accommodate Class J fuses. Provide fuses in accordance with Section 260180 – Overcurrent Protective Devices. Provide disconnects with externally operable handles that give positive visual indication of ON-OFF positions with red and black color coding.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install motor starters in accordance with manufacturer's written instructions, applicable requirements of the NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices.

3.2 METHODS:

A. Install overload units so catalog number is visible. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

B. Where sizes of starters, disconnect, fuses, motor circuit protectors, heaters, etc. are not indicated on drawings, size all equipment in accordance with manufacturer's written instructions.

C. Submit with the record drawings a record of the motor amperage readings of each electrically-driven unit; show horsepower, full-load amps and service factor.

3.3 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each starter cabinet. Provide red plastic laminate label for starter supplied by emergency power. Include mechanical equipment designation, horsepower, voltage, full-load amps, and service factor of motor. Mark on interior cover the source of power by indicating the panel and circuit number.

3.4 MOTOR CONNECTIONS:

A. Each motor shall be connected to the conduit with a length of flexible, seal-tight conduit (minimum of 18"), with proper type fittings. All motor supply circuits shall include a green ground conductor. Check for proper motor rotation on all motors or equipment.

END OF SECTION 260155

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SECTION 260160

PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to panelboards.

1.2 DESCRIPTION OF WORK:

A. Extent of panelboard work is indicated by drawings and schedules and is specified herein.

B. Type of panelboards in this section include the following:

1. Lighting and Appliance Panelboards
2. Power Distribution Panelboards

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures. Include schedule of devices, including, but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.
2. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with all requirements, provide products from one of the follows:

1. General Electric Co.
2. Siemens Energy & Automation, Inc.
3. Square D Co.

2.2 GENERAL:

A. Provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated. Provide overcurrent protective devices, etc. as indicated on drawings for a complete

installation.

B. Where "Spaces" or "Blanks" are indicated on panelboard schedules, provide drilled bus and mounting hardware ready to receive breaker or fusible switch of size indicated on panelboard schedule.

2.3 PANELBOARD ENCLOSURES:

A. Provide Code gauge, galvanized or rust-resistant sheet steel enclosures in sizes and NEMA types to suit respective applications. The size of the wiring gutters and gauge of steel shall be in accordance with the latest NEMA Standards Publication and latest UL standards for panelboards. Flush locks shall not protrude beyond the front of the door. Key all enclosures alike and provide three keys at completion of the project. Fronts shall have adjustable indicating trim clamps, which shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card, with clear plastic covering shall be provided on the inside of the door. The directory cards shall be typewritten to identify each circuit service. Provide panel enclosures with doors hinged to enclosures. Provide ANSI-61 painted finish.

2.4 LIGHTING AND APPLIANCE PANELBOARDS:

A. Provide dead-front, safety-type lighting and appliance panelboards of types and electrical characteristic indicated. Provide aluminum bus bars, full-sized neutral bus, and ground bus. Provide insulated/isolated ground buses where indicated. Include overcurrent protective devices and switches in quantities, ratings, types, and arrangements shown. See Section 260180 – Overcurrent Protective Devices.

B. Rate devices, bussing, supports, etc. equal to or greater than the short circuit current rating indicated. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

2.5 POWER DISTRIBUTION PANELBOARDS:

A. Provide dead-front, safety-type lighting and appliance panelboards of types and electrical characteristic indicated. Provide wall-mounted or floor-standing power distribution panelboards as indicated. Provide panelboards suitable for use as service equipment where required. Provide aluminum bus bars, full-sized neutral bus, and ground bus. Provide insulated/isolated ground buses where indicated. Include overcurrent protective devices and switches in quantities, ratings, types, and arrangements shown. See Section 260180 – Overcurrent Protective Devices.

B. Rate devices, bussing, supports, etc. equal to or greater than the short circuit current rating indicated. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install panelboards in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on both the interior and exterior of each panelboard enclosure indicating name of panelboard. Bolt and nut or rivet labels to enclosure. (Sheet metal screws are not acceptable).

B. All subpanels shall be labeled to identify the main panel that supplies the feeder circuit.

C. Provide red plastic laminate label for panelboards supplied by emergency power.

3.3 MOUNTING:

A. Mount panelboards as indicated, but in no case higher than 6'-6" from finished floor to top of panel. Anchor enclosures firmly to walls and structural surfaces.

B. Provide 4" high concrete pad under floor-standing power distribution panelboards.

3.4 CIRCUIT DIRECTORIES:

A. For lighting and appliance panelboards, provide typed panelboard circuit directories. Indicate load description or name and location. Utilize actual building room numbers, not architectural room numbers used on drawings. Label the panel and circuit that feed this panel.

B. For power distribution panelboards, provide 1/16" thick black plastic laminate labels with 1/4" high lettering for each load served.

1. Provide red plastic laminate label for emergency loads.
2. If circuits are changed in a panel, type the new circuit designation and glue on existing circuit directory. Do not discard existing panelboard schedule unless all circuits have been changed.

3.5 WIRING METHODS:

A. Arrange conductors neatly within enclosure, and secure with suitable nylon ties.

B. Panelboards shall not be used for junction or splicing boxes or as a raceway.

3.6 ARRANGEMENT OF OVERCURRENT PROTECTIVE DEVICES:

A. The overcurrent protective devices shall be in the same sequence and labeled as the panel schedule on the drawings.

END OF SECTION 260160

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SECTION 260170

DISCONNECT SWITCHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to disconnect switches.

1.2 DESCRIPTION OF WORK:

A. Extent of disconnect switch work is indicated by drawings and schedules and is specified herein.

B. Type of disconnects in this section include the following:

1. General Duty Disconnect Switches
2. Heavy Duty Disconnect Switches

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SUBMITTALS:

1. Product Data: Submit manufacturer's data on disconnect switches including specifications, installation instructions, etc.
2. Shop Drawings: Submit dimensioned drawings of disconnects showing accurately scaled layouts of disconnects and enclosures.
3. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with all requirements, provide disconnect switches (fusible and non-fusible) and fusible switches (in power panels) from one of the following:

1. General Electric Co.
2. Siemens Energy & Automation, Inc.
3. Square D Co.

2.2 GENERAL:

A. Provide fusible and/or non-fusible disconnect switches and ancillary components of types, sizes, ratings, and electrical characteristics as indicated. Provide enclosures in NEMA ratings suitable for applications. Provide fuses as indicated; See Section 260180 – Overcurrent Protective Devices.

2.3 GENERAL DUTY DISCONNECT SWITCHES:

A. Provide 240 volt rated, general duty switches in sheet steel enclosures as indicated of types, sizes, ratings, and electrical characteristics indicated and as required to suit respective application. Provide general duty switches for circuits rated 240 volts or less. Construct of spring-assisted, quick-make, quick-break mechanisms. Provide solid neutral as required by application. Equip with operating handle capable of being locked in the OFF position. Provide Class R rejection fuse clips for fusible-type switches.

2.4 HEAVY DUTY DISCONNECT SWITCHES:

A. Provide 600 volt rated, heavy duty switches in sheet steel enclosures as indicated of types, sizes, ratings, and electrical characteristics indicated and as required to suit respective application. Provide heavy duty switches for circuits rated greater than 240 volts, but less than 600 volts. Construct of spring-assisted, quick-make, quick-break mechanisms. Provide solid neutral as required by application. Equip with operating handle capable of being locked in the OFF position. Provide Class R rejection fuse clips for fusible-type switches.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install disconnects in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect indicating name of disconnect or load served. Bolt labels to enclosure. Mark on interior cover the source of power by indicating the panel and circuit number.

B. Provide red plastic laminate label for disconnects supplied by emergency power

3.3 MOUNTING:

A. Mount disconnects as indicated, but in no case higher than 6'-6" from finished floor to top of disconnect. Anchor enclosures firmly to walls and structural surfaces.

END OF SECTION 260170

SECTION 260180

OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 section making reference to overcurrent protective devices.

1.2 DESCRIPTION OF WORK:

A. Extent of overcurrent protective devices is indicated by drawings and schedules and is specified herein.

B. Type of overcurrent protective devices in this section include the following:

1. Molded Case Circuit Breakers
2. Fuses

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 - Electrical General Provisions as applicable.

B. SUBMITTALS:

1. SHOP DRAWINGS: Submit manufacturer's data on overcurrent protective devices including specifications, time-current trip characteristics curves, mounting requirements, installation instructions, etc. Submit dimensioned drawings of overcurrent protective devices.
2. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide overcurrent protective devices and ancillary components of types, sizes, ratings, and electrical characteristics indicated. Provide enclosures in NEMA ratings as indicated and suitable for applications.

2.2 MOLDED CASE CIRCUIT BREAKERS:

A. MANUFACTURERS: Subject to compliance with all requirements, provide molded case circuit breakers from one of the following:

1. General Electric Co.
2. Siemens Energy & Automation, Inc.
3. Square D Co.

B. MOLDED CASE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breakers as integral components of lighting and appliance panelboards, power panelboards, switchboards, and for individual mounting as indicated. Provide thermal magnetic, molded case circuit breakers of amperages, voltages, types, and short circuit current ratings indicated. Provide bolt-on type breakers only. Construct with quick-break, quick-break mechanism with inverse-time delay and instantaneous trip protection for each pole. Provide breakers rated for ambient temperatures to suit respective applications. Provide mechanical screw type removable copper connector lugs of size to accommodate conductors specified.
2. Provide breakers that have interrupting ratings greater than or equal to the specified fault current. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

2.3 FUSES:

A. VENDORS: Subject to compliance with all requirements, provide fuses from one of the following:

1. Bussmann
2. Gould Shawmut
3. Reliance
4. Littlefuse

B. FUSES: Provide fuses as integral components of disconnects, fusible switches, and bolted pressure switches. Provide fuses in types and sizes as recommended by manufacturer's written instructions. Provide fuses for mains, feeders, and branch circuits as follows:

1. Circuits 601 to 6000 amperes: Shall be protected by current limiting Bussmann Low-Peak Time-Delay Fuses KRP-C or equivalent. Fuses shall be UL Class L with an interrupting rating of 200,000 amperes r.m.s. symmetrical.
2. Motor and Transformer Circuits 0 to 600 amperes: Shall be protected by current-limiting Bussmann Low-Peak Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) or equivalent. Fuses shall be UL Class RK1 with an interrupting rating of 200,000 amperes r.m.s. symmetrical.
3. Feeders to Circuit Breaker Panels 0 to 600 amperes: Shall be protected by current-limiting Bussmann Low-Peak Time Delay fuses LPJ or equivalent. Fuses shall be UL Class RK1 with an interrupting rating of 200,000 amperes r.m.s. symmetrical.

C. FUSE CABINETS:

1. Furnish and install fuse cabinet(s) equivalent to Bussmann SFC-FUSE-CAB.
2. . Provide Taylor model PND-R or equivalent from one of the approved manufacturers.

2.4 GENERAL:

A. Install overcurrent protective devices in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

2.5 SIZING FUSES:

A. Size all fuses in accordance with manufacturer's written recommendations, whether fuse size is

indicated on drawings or not. If nuisance tripping occurs, increase fuse size and disconnect if necessary as required to provide nuisance-free tripping. Adjust fuse size for proper ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times.

2.6 IDENTIFICATION:

A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect indicating name of disconnect or load served. Bolt labels to enclosure. Mark on interior cover the source of power by indicating the panel and circuit number.

B. Provide red plastic laminate label for disconnects supplied by emergency power.

2.7 MOUNTING:

A. Mount disconnects as indicated, but in no case higher than 6'-6" from finished floor to top of disconnect. Anchor enclosures firmly to walls and structural surfaces.

2.8 SETTINGS:

A. Adjust settings of overcurrent protective devices as directed by the Overcurrent Protective Device Coordination Study.

2.9 SPARE PARTS:

A. Spare Fuses: For each type and ampere rating, furnish one spare fuse for every 5 provided, but not less than three total.

B. Fuse Cabinets: Furnish and install fuse cabinet(s) in quantities as required, but in no case less than one, to house the spare fuses indicated above. Locate in main electrical room as directed by the Electrical Engineer.

END OF SECTION 260180

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SECTION 260289

SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Type 2 Surge Protective Devices for low-voltage power.

B. Related Sections include the following:

1. Division 26 Section "Panelboards" for factory-installed SPDs.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protection Rating.

C. SPD: Surge Protection Device.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For surge protective devices, signed by product manufacturer certifying compliance with the following standards:

1. UL 1283.
2. UL 1449 3rd Edition.
3. UL 281-1 (fuse)
4. CSA 22.2.
5. NEMA LS-1

C. Manufacturer Seismic Qualification Certification: Submit certification that surge protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based

and their installation requirements.

D. Products Testing: For surge protective devices, provide the following product test data:

1. Provide actual let through voltage test data in the form of oscillograph results for the ANSA/IEEE C62.41 Category C3 & C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.
2. Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the device noise attenuation equal or exceeds 50 db at 100 kHz.
3. Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying that surge protection devicecomponents can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

E. Field quality-control test reports, including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

F. Operation and Maintenance Data: For surge protective devices to include in emergency, operation, and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ANSI/IEEE C62.41.1-2002, "IEEE Guide for Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits," IEEE C62.41.2-2002, “IEEE Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits,” and test devices according to IEEE C62.45-2002, "IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."

C. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

D. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 2nd Edition, "Surge Protective Devices."

E. The manufacturer shall be ISO 9000 certified.

F. Comply with Military Standards MIL-STD220A.

G. Comply with FIPS Pub 94.

H. Comply with NEC 2008, Article 285, “Surge Protective Devices.”

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: -40 to 140 deg F.
3. Humidity: 5 to 95 percent, non-condensing.
4. Altitude: Up to 20,000 feet above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted surge protection devices to allow adequate clearances for maintenance. Coordinate placement of breakers in electrical panelboards feeding field-mounted surge protection devices so that conductor leads are kept to an absolute minimum.

B. Coordinate surge protection devices with Division 26 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge protection devices that fail in materials or workmanship within five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology, Inc.
2. Cutler-Hammer, Inc.; Eaton Corporation.
3. EFI Electronics
4. General Electric Company.
5. LEA International.
6. Leviton Mfg. Company Inc.
7. Liebert Corporation; a division of Emerson.
8. Siemens Energy & Automation, Inc.
9. Square D; Schneider Electric.
10. United Power Corporation.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge protection device for the service entrance and other distribution level. The

system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes – For a wye-configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
5. UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum UL 1449 3rd Edition VPR for the device must not exceed the following:
   a. 208Y/120 V:
      1) L-N; L-G; N-G: 700 V.
      2) L-L: 1200 V.
   b. 480Y/277 V:
      1) L-N; L-G; N-G: 1200 V.
      2) L-L: 2000 V.
6. ANSI/IEEE Cat. C3 Let Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:
   a. 208Y/120 V L-N: 560 V.
   b. 480Y/277 V L-N: 960 V.
7. ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:
   a. 208Y/120 V L-N: 160 V.
   b. 480Y/277 V L-N: 165 V.

B. SPD Design

1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating SPD modules shall not be acceptable.
2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.
3. Extended Range Filter – The Surge Protective Device shall have a High Frequency Extended Range Tracking Filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies:
   a. Insertion Loss (ratio):
      1) 50kHz: 40
      2) 100kHz: 316
      3) 500kHz: 316
      4) 1MHz: 89
      5) 10MHz: 200
      6) 100MHz: 79
   b. Insertion Loss (dB):
      1) 50kHz: 32
      2) 100kHz: 50
      3) 500kHz: 50
      4) 1MHz: 39
      5) 10MHz: 46
      6) 100MHz: 38
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

5. Standard Monitoring Diagnostics – Each SPD shall provide integral monitoring options:
    a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light shall indicate which phase(s) have been damaged.
    b. Contacts for Remote Status Monitoring – The SPD device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.
6. Monitoring Diagnostics:
    a. Audible Alarm – The SPD shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.
    b. Event Counter – The SPD shall be equipped with a LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective category after significant even occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.
    c. Push to Test – The SPD shall be equipped with push-to-test feature, designed to provide users with real time testing of the surge protection device's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.
7. Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:
    a. Individual Fusing: MOVs shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events. SPD shall safely reach an end-of-life condition when subjected to fault current levels between 0 and 200 kA, including low level fault currents from 5 to 5000 amperes.
    b. Thermal Protection: MOVs shall be equipped with Thermal Fuse Spring (TFS) technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A,
    c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 2002:

1. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50 microseconds, 20kV open circuit voltage. 8 x 20 microsecond, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:
    a. Service Entrance: 5000 impulse per mode.
    b. Distribution Locations: 5000 impulse per mode.
    c. Branch Locations: 5000 impulse per mode.

2.3 SYSTEM APPLICATION

A. Locations – Electrical drawings indicate the location and IEEE Category requirements of all required SPD's.

B. Surge Current Capacity – The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as follows:

1. IEEE Category “C” Locations:
   a. Per Phase: 250kA.
   b. Per Mode: 125kA.
2. IEEE Category “B” Locations:
   a. Per Phase: 160kA.
   b. Per Mode: 80kA.
3. IEEE Category “A” Locations:
   a. Per Phase: 120kA.
   b. Per Mode: 60kA.

C. Lighting and Appliance Panelboard Requirements:

1. Factory-Installed SPD Option:
   a. The SPD shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.
   b. The SPD shall be immediately installed on the load side of the main breaker or main lugs.
   c. The panelboard shall be capable of re-energizing upon removal of the SPD.
   d. A direct bus bar connection shall be used to mount the SPD component to the panelboard bus bar to reduce the impedance of the shunt path.
   e. The SPD panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and SPD device in not acceptable). SPD units that use a cable connection do not meet the intent of this specification. For this option, the breaker shown on the electrical drawings shall be deleted.
   f. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
   g. The SPD shall be of the same manufacturer as the panelboard.
   h. The complete panelboard including the SPD shall be UL67 listed.

D. Power Distribution Panelboard, Motor Control Center, and Switchboard Requirements:

1. Factory-Installed SPD Option:
   a. The SPD shall be of the same manufacturer as the power distribution panelboard, motor control center, or switchboard.
   b. The SPD shall be factory installed inside the power distribution panelboard, motor control center, or switchboard at the assembly point by the original equipment manufacturer.
   c. Locate surge protection device on load side of main disconnect device or main lugs, as close as possible to the phase conductors and ground/neutral bar.
   d. Provide a disconnect sized in accordance with all manufacturer’s recommendations. The disconnect shall be directly integrated to the surge protection device and assembly bus by using bolted bus bar connections. The disconnect is the preferred method. If otherwise recommended by the manufacturer, provide a multi-pole circuit breaker in the panelboard in size as recommended by the manufacturer to feed the surge protection device. The size of the breaker shall supersede the size of the breaker shown on the electrical drawings. Provide copper conductors in size as recommended by the manufacturer for connecting the phases, neutral, and ground between the surge protection device and the circuit breaker in the panelboard. The size of the conductor shall supersede the size of the conductors shown on the electrical drawings.
   e. The SPD shall be integral to power distribution panelboard, motor control center, or switchboard as factory standardized design.
   f. All monitoring diagnostics features shall be visible from the front of the equipment.

2.4 ENCLOSURES

A. Provide enclosures suitable for locations as indicated on the drawings or as described below:

1. NEMA 1/3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.
2. NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids. (Panelboards Only)
3. NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Unites Only)

PART 3 – EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between surge protection device and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground at SPD.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect electrical equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field tests and inspections and prepare test reports:

1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain surge protective devices. Refer to Division 1 Section "Closeout Procedures" or "Demonstration and Training" as may be applicable.

END OF SECTION 260289

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SECTION 260435

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1. Coordination of series-rated devices is permitted where indicated on Drawings.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five(5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies of the short-circuit input and output data, where required, shall be provided on CD in PDF format.

B. For large system studies with more than 200 bus locations, the contractor is required to provide the study project files to the owner in electronic format. In addition, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the owner to review all aspects of the project and print arc flash labels, one-line diagrams, and other items.

C. The report shall include the following sections:

1. Executive summary

2. Descriptions, purpose, basis, and scope of the study
3. Tabulations of circuit breaker, fuse, and other protective device rating versus calculated short circuit duties
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
5. Fault current calculations, including a definition of terms and guide for interpretation of the computer printout
6. Details of the incident energy and flash protection boundary calculations
7. Recommendations for system improvements, where needed
8. One-line diagram

D. Arc flash labels shall be provided in hard copy only.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. The equipment manufacturer or approved engineering firm shall demonstrate experience with arc flash hazard analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

D. The contractor shall furnish an arc flash hazard analysis study, per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

E. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

F. Comply with IEEE 399 for general study procedures.

G. Comply with 1584 – Guide for Performing Arc-Flash Hazard Calculations.

PART 2 – PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.

5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
   a. Arcing faults.
   b. Simultaneous faults.
   c. Explicit negative sequence.
   d. Mutual coupling in zero sequence.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
   a. Circuit-breaker and fuse-current ratings and types.
   b. Relays and associated power and current transformer ratings and ratios.
   c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
   d. Generator kilovolt amperes, size, voltage, and source impedance.
   e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
   f. Busway ampacity and impedance.
   g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with

tag numbers on diagram, showing the following:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Medium-voltage controller.
3. Motor-control center.
4. Distribution panelboard.
5. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers:
   a. ANSI C57.12.10.
   b. ANSI C57.12.22.
   c. ANSI C57.12.40.
   d. IEEE C57.12.00.
   e. IEEE C57.96.
2. Medium-Voltage Circuit Breakers: IEEE C37.010.
3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
   a. Inrush current when first energized.
   b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
   a. Device tag.
   b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
   c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
   d. Fuse-current rating and type.
   e. Ground-fault relay-pickup and time-delay settings.
2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to

achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

3.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.

C. The arc flash hazard analysis shall include all panelboard locations down to 240 volt and 208 volt systems, where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary, considering an incident energy of 1.2 cal/cm2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum mother contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into considering the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows.

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and

load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker, as required above, the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to computer the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds, based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

3.6 ARC FLASH WARNING LABELS

A. The contractor of the arc flash hazard analysis shall provide a 3.5 inch x 5 inch thermal transfer-type label of high adhesion polyester for each work location analyzed.

B. All labels will be based on recommended overcurrent device setting and will be provided after the results of the analysis have been presented to the owner, and after any system changes, upgrades, or modifications have been incorporated in the system.

C. The label shall included the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number, and issue date

D. Labels shall be machine-printing, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480, and applicable 208 volt panelboard, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low-voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, on flash label shall be provided.
5. For medium voltage switches, one arc flash label shall be provided.

F. Labels shall be field-installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.7 ARC FLASH TRAINING

A. The contractor of the arc flash hazard analysis shall train the owner’s qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET), or equivalent.

END OF SECTION 260435

SECTION 260452

GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to grounding.

1.2 DESCRIPTION OF WORK:

A. Extent of grounding work is indicated by drawings and schedules and is specified herein.

B. Ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, equipment, and separately derived systems in accordance with the NEC and all other applicable codes to provide a permanent, continuous, low impedance, grounding system.

C. Provide grounding system such that the resistance from the service entrance ground bus, through the grounding electrode to earth is not greater than 5 ohms.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. TESTING: Submit results of ground resistance testing as specified in this section. Include name of testing agency with report. Include test results in operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide grounding equipment and accessories of types, sizes, ratings, and electrical characteristics indicated or as otherwise required to provide a complete system.

2.2 GROUNDING CONDUCTORS:

A. Unless noted otherwise, provide grounding conductors with stranding and insulation types to match phase conductors. Provide conductors with green insulation if possible; otherwise wrap with green tape. Size ground conductors as indicated on drawings. Do not size ground conductors smaller than that allowable by NEC.

2.3 GROUND RODS:

A. Provide copper clad, steel, 3/4" diameter by 10' long, ground rods (Weaver, Cadweld, or equivalent).

2.4 TEST WELLS:

A. Provide precast concrete box 9-1/2" W. x 16" L. x 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "Ground Rod".

2.5 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND):

A. Provide a bare copper conductor encased along the bottom of concrete foundation or footing that is in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Size UFER ground conductor in accordance with the NEC. Extend conductor through a horizontal length of 30' minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils.

2.6 INSULATED GROUNDING BUSHINGS:

A. Provide plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners (OZ Gedney BLG or equivalent).

2.7 CONNECTION TO PIPES:

A. Provide heavy duty, cast bronze, ground clamp systems with silicon bronze bolts and nuts (OZ Gedney G Series - B or equivalent).

2.8 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES:

A. Provide exothermic welds. (Cadweld or equivalent)

2.9 BONDING JUMPERS:

A. Provide bonding jumpers with hot dip galvanized malleable or ductile iron clamps, hot dip galvanized steel U-bolts, and tinned copper braids (OZ Gedney BJ Series or equivalent).

2.10 GROUND BUS:

A. Provide 1/4" x 4", copper ground bus complete with insulators and brackets in lengths and at mounting heights as indicated on drawings. Furnish complete with drilled holes and lugs to accommodate grounding conductors.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install grounding systems in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CLEANING:

A. Thoroughly clean all metal contact surfaces prior to installation of clamp-on connectors.

3.3 SERVICE ENTRANCE GROUNDING:

A. Connect the following items using NEC sized copper grounding conductors (in NEC sized,

conduits if concealment is required) to lugs on the service ground bus:

1. Conductor from the UFER ground.
2. Conductor from two ground rods driven exterior to building at not less than 10' apart.
3. Conductor from main incoming cold water piping system.
4. Conductor from building structural steel.
5. Conductor from separately derived systems.
6. Conductor from insulated ground bushings on service entrance conduits.
7. Additional ground rods as required to achieve resistance value specified.
8. Additional items indicated on drawings.

3.4 EQUIPMENT BONDING AND GROUNDING:

A. Provide an NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Full length of all multi-outlet assemblies and other surface wireways.

3.5 ADDITIONAL GROUNDING INSTALLATION REQUIREMENTS:

A. Provide grounding bushings on all service conduit and conduits installed in concentric/eccentric knock-outs or reducing washer at panelboards, cabinets, and gutters.

B. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system. Connection to water piping system shall be made electrically continuous by connecting to the street side of the water main valve and/or installing additional bonding jumpers across the meter, valves or service unions that might be disconnected.

C. Provide bonding wire in all flexible conduits.

D. Isolated Ground Circuits: Circuits used for isolated ground outlets shall be run in separate raceways or shall have a separate green insulated ground conductor installed and tagged for identification at all outlet and junction boxes.

3.6 TEST WELLS:

A. All ground rods shall be driven external to building and shall be located in ground well boxes. Locate in landscaped areas where possible.

3.7 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section. Use independent testing agency for all testing.

END OF SECTION 260452

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SECTION 260560

NETWORK LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2. SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
C. System devices indicated shall be networked together enabling digital communication and shall be individually addressable.
D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
E. The system architecture shall facilitate remote operation via a computer connection.
F. The system shall not require any centrally hardwired switching equipment.
G. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

1.3. DEFINITIONS

A. NA

1.4. SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)
B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
C. Other Diagrams – as needed for special operation or interaction with other system(s)
D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
E. Hardware and Software Operation Manuals
F. Other operational descriptions as needed

1.5. QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.6. COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.
B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.
C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.7. WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

1.8. SPARE PARTS

A. Provide a minimum of 5%, but not less than three (3) of each type of devices as follows:

1. Low voltage lighting control wall switches – each type utilized.
2. Daylight sensors.
3. Occupancy sensors.
4. Power (relay) packs.
5. Auxiliary input/output (I/O) Devices.

PART 2 – PRODUCTS

2.1. MANUFACTURERS

A. Basis of Design: This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).
B. Subject to compliance with all requirements, Digital Lighting Management System from Wattstopper, a LeGrande Company (408-988-5331, www.wattstopper.com) is also acceptable.

2.2. SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see *Networked LED Luminaire* section)
D. Intelligent lighting control devices shall communicate digitally, require <4 mA of current to function (Graphic wall stations excluded), and posses RJ-45 style connectors.
E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the “bridge” devices and all cabling that connects zones to bridge devices.

N. WiFi enabled devices shall be able to detect when WiFi network is down and revert to a user directed default state.

O. WiFi-enabled devices shall be capable of current monitoring

P. WiFi-enabled devices shall utilize WPA2 AES encryption

Q. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks

R. WiFi-enabled devices shall have at least one local RJ-45 port for communicating with nonWiFi-enabled system devices

S. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.

T. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

U. Devices located in different lighting zones shall be able to communicate occupancy, photocell, and switch information via either the wired or WiFi backbone.

V. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.

a. Auto-On / Auto-Off (via occupancy sensors)
    - Zones with occupancy sensors automatically turn lights on when occupant is detected.
    - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
    - Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

b. Manual-On / Auto-Off (also called Semi-Automatic)
    - Pushing a switch will turn lights on.

- Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

c. Manual-On to Auto-On/Auto-Off
- Pushing a switch will turn lights on.
- After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
- Sequence can be reset via scheduled (ex. daily each morning) events

d. Auto-to-Override On
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
- Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
- Sequence can be reset via scheduled (ex. daily each morning) events

e. Manual-to-Override On
- Pushing a switch will turn lights on.
- Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
- Sequence can be reset via scheduled (ex. daily each morning) events

f. Auto On / Predictive Off
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
- Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
- If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

g. Multi-Level Operation (multiple lighting levels per manual button press)
- Operating mode designed specifically for bi-level applications
- Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
- Eliminates user confusion as to which of two buttons controls which load
- Three different transition sequences are available in order to comply with energy codes or user preference)
- Mode available as a setting on all nLight devices that have single manual on/off switch (ex. nWSX, nPODM, nPODM-DX).
- Depending on the sequence selected, every button push steps through relays states according to below table
- In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

	Alternating Sequence		**Full On Sequence**		**3 Step On Sequence**	
Sequence State #	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On

3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(*step only present for devices without separate off button)

W. A taskbar style desktop application shall be available for personal lighting control.

X. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

Y. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

Z. Control software shall enable integration with a BMS via BACnet IP.

AA. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3. INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway)

a. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet.
b. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
c. Control device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to lighting control devices.
d. Device shall automatically detect all devices downstream of it.
e. Device shall have a standard and astronomical internal time clock.
f. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
g. Device shall have a USB port
h. Each control gateway device shall be capable of linking 1500 devices to the management software.
i. Device shall be capable of using a dedicated or DHCP assigned IP address.
j. Network Control Gateway device shall be the following Sensor Switch model Series:

nGWY2

B. Networked System Occupancy Sensors

a. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

b. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

c. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

d. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

e. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

f. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

g. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.

h. Sensors shall be available in multiple lens options which are customized for specific applications.

i. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

j. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.

k. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

l. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

m. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.

n. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.

o. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.

p. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

q. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.

r. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)

s. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls

t. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:

nWSD or nWSX (PIR, 1 Relay)

nWSD PDT or nWSX PDT (Dual Tech, 1 Relay)

nWSD NL (PIR w/ Night Light, 1 Relay)

nWSD PDT NL (Dual Tech w/ Night Light, 1 Relay)

nWSX NL LV (PIR w/ Night Light, No Relay)

nWSD PDT NL LV (Dual Tech w/ Night Light, No Relay)

nWSD LV or nWSX LV (PIR, No Relay, Raise/Lower Dim Ctrl)

nWSD PDT LV or nWSX PDT LV (Dual Tech w/ Night Light, No Relay, Raise/Lower Dim Ctrl)

u. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
v. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
w. Embedded sensors shall have an optional photocell
x. Embedded sensors shall be the following Sensor Switch model number:

nES 7 (PIR, No Relay)
nES 7 ADCX (PIR w/ Photocell, No Relay)
nES PDT 7 (Dual Technology, No Relay)
nES PDT 7 ADCX (Dual Technology w/ Photocell, No Relay)

y. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
z. Fixture mount sensors shall be capable of powering themselves via a line power feed.
aa. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
bb. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
cc. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCMR(B) 9	1	1	Standard	PIR
nCMR(B) 9 2P	2	2	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCMR(B) PDT 9	1	1	Standard	Dual
nCMR(B) PDT 9 2P	2	2	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCMR(B) 10	1	1	Extended	PIR
nCMR(B) 10 2P	2	2	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCMR(B) PDT 10	1	1	Extended	Dual
nCMR(B) PDT 10 2P	2	2	Extended	Dual
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCMR(B) 6	1	1	High Bay	PIR
nCMR(B) 6 2P	2	2	High Bay	PIR
nCMR(B) 6 480	1	2	High Bay	PIR

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

bb. System shall have WiFi enabled fixture mountable sensors available.

cc. Embedded sensors shall have an optional photocell and 0-10 VDC dimming output

dd. WiFi enable sensors shall be one of the Sensor Switch model numbers:

nCMRB 6 WIFI (PIR, w/ Relay)
nCMRB 10 WIFI (PIR, w/ Relay)
nCMRB 50 WIFI (PIR, w/ Relay)
nCMRB 9 WIFI (PIR, w/ Relay)

C. Networked System Daylight (Photocell and or Dimming) Sensors

a. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
b. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
c. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
d. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
e. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
f. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
g. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
h. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
i. Sensor shall be the following Sensor Switch model numbers, with device options as specified:

nCM(B) PC (on/off))

nCM(B) ADC (dimming)

nCM(B) PC ADC (on/off, 0-10 VDC dimming)

nCMR(B) PC (on/off, single relay)

nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

j. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
k. Embedded sensors shall be the following Sensor Switch model number:

nES ADCX (Dimming Photocell)

D. Networked System Power (Relay) Packs

a. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
b. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
c. All devices shall have two RJ-45 ports.
d. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
e. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
f. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
g. Power Packs and Power Supplies shall be available that are WiFi enabled.
h. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
i. Power (Secondary) Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.
j. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts/LED drivers.
k. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
l. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
m. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
n. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
o. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
p. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
q. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
r. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
s. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:

nPP16 (Power Pack w/ 16A relay)

nPP16 WIFI (Power Pack w/ 16A relay, WIFI enabled)

nEPP5 D (Power Pack w/ 5A relay and 0-10VDC dimming output)

nSP16 (Secondary Pack w/ 16A relay)

nSP5 2P (Secondary Pack w/ two 5A relays)

nSP5 D (Secondary Pack w/ 5A relay and 0-10VDC dimming output)

nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)

nSP5 D ER (UL924 Listed Secondary Pack w/ 5A relay and 0-10VDC dimming output for switching emergency power circuits)

nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)

nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)

nSP5 PCD MLV (Secondary Pack w/ 5A relay and magnetic low voltage dimming output)

nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)

nSP5 480 (Secondary Pack w/ 5A relay for switching 208/240/480 VAC loads

nSP5 2P LVR (Louver/Damper Control Pack

nSHADE (Pulse On/Off Control Pack

nPS 80 (Auxiliary Bus Power Supply)

nPS 80 WIFI (Auxiliary Bus Power Supply, WiFi enabled)

nAR 40 (Low voltage auxiliary relay pack)

E. Networked System Relay & Dimming Panels

dd. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
ee. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
ff. Panel shall provide one 0-10VDC dimming output paired with each relay.
gg. Panel shall power itself from an integrated 120/277 VAC supply.
hh. Panel shall be capable of operating as either two networked devices or as one.
ii. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
jj. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection
kk. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:

nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)

nPANEL 2 480 (Panel w/ two dual phase relays (208/240/480 VAC) and two 0-10

VDC dimming outputs)

F. Networked Auxiliary Input / Output (I/O) Devices

a. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
b. Devices shall have two RJ-45 ports
c. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.

d. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
e. Specific I/O devices shall have an input that read a 0-10 VDC signal from an external device.
f. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, run a local/remote control profile, or raise/lower a dimming output
g. Specific I/O devices shall sense state of low voltage outdoor photocells
h. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
i. Specific I/O devices shall sense .
j. Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:

nIO D (I/O device with 0-10 dimming output)

nIO 1S or nIO RLX (I/O device with contact closure or 0-10VDC dimming input)

nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in

nIO PC KIT only)

nIO X (Interface device for communicating with RS-232 enabled AV Touch

Screens

G. Networked LED Luminaires

a. Networked LED luminaire shall have a mechanically integrated control device
b. Networked LED luminaire shall have two RJ-45 ports
c. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
d. Networked LED luminaire shall provide low voltage power to other networked control devices
e. System shall be able to turn on/off LED luminaire without using a relay
f. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
g. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
k. LED Luminaires shall be the following Lithonia model families:

RTLED

TLED

VLED

ACLED

AL LED

WLED

STLED

MINO

H. Networked System Wall Switches & Dimmers

a. Devices shall recess into single-gang switch box and fit a standard GFI opening.
b. Devices shall be available with zero or one integrated Class 1 switching relay.
c. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
d. All sensors shall have two RJ-45 ports.

e. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
f. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
g. Devices with dimming control outputs can control 0-10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
h. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
i. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
j. Devices with mechanical push-buttons shall be made available with custom button labeling
k. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
l. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:

nPOD (single on/off, capacitive touch, audible user feedback)

nPOD 2P (dual on/off, capacitive touch, audible user feedback)

nPODR (single on/off, one relay, capacitive touch, audible user feedback)

nPODM (single on/off, push-buttons, LED user feedback)

nPODM 2P (dual on/off, push-buttons, LED user feedback)

nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)

nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)

nPODM 4P (quad on/off, push-buttons, LED user feedback)

nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

I. Networked System Graphic Wall Station

a. Device shall have a 3.5” full color touch screen for selecting up to 8 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
b. Device shall enable configuration of lighting presets, switched, and dimmers via password protected setup screens.
c. Device shall enable user supplied .jpg screen saver image to be uploaded.
d. Device shall surface mount to single-gang switch box
e. Device shall have a micro-USB style connector for local computer connectivity.
f. Device shall have two RJ-45 ports for communication
g. Device shall be the following Sensor Switch model number:

nPOD GFX

J. Networked System Scene Controllers

a. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
b. Device shall recess into single-gang switch box and fit a standard GFI opening.
c. Devices shall provide LED user feedback.
d. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
e. All sensors shall have two RJ-45 ports.
f. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.

g. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
h. Device shall have LEDs indicating current selection.
i. Scene Selector device shall be the following Sensor Switch model number:

nPODM 2S (2 Scene, push-button)
nPODM 4S (4 Scene, push-button)
nPODM 4S DX (4 Scene, push-button, On/Off/Raise/Lower)
nPODM 4L DX (4 Adjustable Presets, push-button, On/Off/Raise/Lower)

K. Communication Bridges

a. Device shall surface mount to a standard 4" x 4" square junction box.
b. Device shall have 8 RJ-45 ports.
c. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
d. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
e. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
f. Communication Bridge devices shall be the following Sensor Switch model numbers:

nBRG 8 (8 Ports)

2.4. LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.
F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.
G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
E. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5. MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
D. A printable network inventory report shall be available via the software.
E. A printable report detailing all system profiles shall be available via the software.
F. Software shall require all users to login with a User Name and Password.
G. Software shall provide at least three permission levels for users.
H. All sensitive stored information and privileged communication by the software shall be encrypted.
I. All device firmware and system software updates must be available for automatic download and installation via the internet.
J. Software shall be capable of managing systems interconnected via a WAN (wide area network).
K. Programming language and computing platform shall be HTML-based. JavaScript is not allowed.

2.6. BMS COMPATIBILITY

A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. No additional hardware shall be required.
B. BACnet IP gateway software shall communicate information gathered by networked system to other building management systems.
C. BACnet IP gateway software shall translate and forward lighting relay and other select control commands from BMS system to networked control devices.

2.7. SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.
B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO_2.
D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).
E. Energy savings data shall be calculated for the system as a whole or for individual zones.
F. A time scaled graph showing all relay transitions shall be presented.
G. A time scaled graph showing a zones occupancy time delay shall be presented
H. A time scaled graph showing the total light level shall be presented.
I. User shall be able to customize the baseline run-time hours for a space.
J. User shall be able to customize up to four time-of-day billing rates and schedules.
K. Data shall be made available via a .CSV file

2.8. START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.
B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
D. All system devices shall be capable of being given user defined names.
E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.
F. All sensor devices shall have the ability to detect improper communication wiring and blink it's LED in a specific cadence as to alert installation/startup personnel.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways except within consoles and cabinets and except in accessible ceiling spaces where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Comply with requirements for raceways specified in Section 26 0110 "Conduit Raceways."
3. Cables installed above accessible ceilings shall be installed in a neat workmanlike manner at right angle to structure.
4. Provide j-hooks for support of cables above accessible ceiling space.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, boxes, cabinets, and terminals.

B. Identify all ceiling-mounted controls with data bus number and device address.

C. Label each device cable within 6 inches (152 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test continuity of each circuit.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test each bus controller using local and remote controls.
2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Field Test Reports:

1. Printed list of all points created from actual queries of all addressed control points to include lamps, ballasts, manual controls, and sensors.
2. Event log verifying the performance of all devices generating event messages to include occupancy sensors, control buttons, alarm messages, and any other change of value messages.

D. Lighting controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies bus controllers included and describes query results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.4 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. Activate luminaires and verify that all lamps are operating at 100 percent.
3. Confirm correct communications wiring, initiate communications between DALI devices and controller/gateways, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to four visits to Project during other-than-normal occupancy hours for this purpose.

3.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for five years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within five years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

3.8 OPERATIONS TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

D. Video tape training and provide electronic file of video to the Davis School District.

3.9 MAINTENANCE AND REPAIR TRAINING

A. The contractor shall provide and implement a complete and comprehensive training program for all maintenance personnel. This mandatory training program will provide a complete understanding of how to maintain and repair the system.

B. The training program shall be implemented by a factory trained certified technician on the school site. Two (2) maintenance personnel from the Davis School District shall be trained to a "certified" level and receive a certificate.

C. All training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the maintenance personnel who attended, received, and completed the training program.

END OF SECTION 26 0560

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SECTION 260800

COMMISSIONING & TESTING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes work related to the commissioning and testing of electrical systems covered under Divisions 26, 27 and 28. For the specific commissioning and testing requirements of each electrical system, refer to individual electrical system specifications.

B. The commissioning authority shall review and approve all test procedures, forms, and have ability to attend the commissioning and testing activities conducted as part of the contract.

C. Where commissioning is required under other divisions that relate to electrical, such as mechanical and plumbing divisions (Division 22, 23, and 25), the contractor shall include all related electrical commissioning and testing to complete the commissioning and testing under other divisions.

D. The purpose of the commissioning and testing of electrical systems is to demonstrate that the equipment and systems are ready and safe for operation and that they are performing to the intended design level and/or intent.

1.3 ELECTRICAL SYSTEMS TO BE COMMISSIONED/TESTED

Commission and/or test the following electrical systems in compliance with section requirements:

1. Section 26 0070 – Electrical Connections for Equipment
2. Section 26 0435 – Protective Device Study
3. Section 26 0560 – Network Lighting Control System
4. Section 27 1300 – Communications Horizontal Cabling
5. Section 27 3100 – Public Safety Distributed Antenna Systems
6. Section 28 0721 – Digital, Addressable Fire-Alarm System
7. Section 28 0730 – Access Control and Intrusion Detection System
8. Section 28 2300 – Video Surveillance

1.4 DEFINITIONS

A. CTC: Certified Testing Company.

B. NETA ATS: Acceptance Testing Specification.

1.5 ACTION SUBMITTALS

A. Not Required.

1.6 INFORMATIONAL SUBMITTALS

A. For each system to be commissioned and tested, submit the commissioning/testing procedures, list of equipment, modes to be tested, and CTS. Include all forms, checklists, and report formats that will be used to collect, record, and demonstrate the commissioning and testing has been completed in compliance with the contract documents.

B. Qualification Data: For certified testing agency.

C. Field quality-control commissioning and testing/reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Industry standard testing equipment shall be used to perform start-up, initial check-out, prefunctional, and required functional testing applicable to the equipment or system being commissioned and/or tested.

B. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified or established by industry standards and shall have been calibrated within the last 12 months or as specified herein. Equipment shall be calibrated according to the recommended manufacturer intervals and when damaged, dropped, or reading are in question. Calibration tags shall be affixed or certificates of calibration available upon request.

PART 3 - EXECUTION

3.1 PREFUNCTIONAL TESTING

A. Conduct prefunctional testing as required, make remedies and adjustments to the equipment or systems as determined until the prefunctional testing has been completed with acceptable results.

B. Follow the approved prefunctional testing and check-out procedures.

C. This testing shall be completed prior to energizing and start-up of equipment and systems.

D. Submit prefunctional test reports and obtain approval from the commissioning authority prior to proceeding to start-up.

3.2 START-UP

A. Complete start-up checklists and follow the manufacturer's published instructions for start-up of equipment and systems.

B. Submit start-up checklists, and reports with data collected during start-up.

3.3 REMEDIES AND RETESTING

A. Provide adjustments to settings, corrections to installations, and corrections to equipment and systems as required until they are operating as designed and within acceptable performance levels.

B. Complete retesting of equipment and systems where changes are made.

C. The correction and retesting sequences shall continue until acceptable performance levels and the proper operation of the equipment and systems have been met.

3.4 OWNER TRAINING

A. Conduct required owner trainings for the required equipment and systems in accordance with each section.

B. Trainings shall be video recorded, submit (3) electronic copies of the training video recording to the Owner within the O&M manuals. The Video format shall be a standard format that can be viewed on any DVD player.

3.5 DOCUMENTATION AND O&M MANUALS

A. Submit documentation as requested to demonstrate compliance with the commissioning and testing requirements of equipment and systems

B. Include copies of commissioning and testing checklists, reports, data collected, final settings, and other pertinent data within the Owners O&M manuals.

END OF SECTION 260800

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SECTION 260810

HEAT CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish a complete system of heating cables, components, and controls, specifically for keeping water drainage paths clear and to avoid ice dams on roof eaves, gutters, and downspouts.

B. Related Sections:
   1. Section 073100 - Shingles and Shake: Installation coordination with roofing material and details
   2. Section 073200 - Roof Tiles: Installation coordination with roofing material and details.
   3. Section 074100 - Roof Panels: Installation coordination with roofing material and details.
   4. Section 075000 – Membrane Roofing: Installation coordination with gutter material and details.
   5. Section 076000 – Flashing and Sheet Metal: Installation coordination with gutter material and details.
   6. Section 077000 – Roof and Wall Specialties and Accessories: Installation coordination with gutter material and details.
   7. Section 260600 – Schedules for Electrical: Materials and installation of wiring and electrical power source.

1.2 SYSTEM DESCRIPTION

A. The system shall consist of all equipment and materials to keep water drainage paths clear and/or avoid ice dams on roof eaves, gutters, and downspouts.

B. The area covered and heat density (measured by Watts or BTU equivalent) per lineal foot of heating element or square foot of area for each product are determined by the heat output and the spacing between adjacent runs of heating element. See manufacturer's installation instructions for more detailed information.

1.3 ELECTRICAL CODES AND STANDARDS

A. The entire design and installation of the Heatizon GutterMelt® SR Cable System shall comply with the Manufacture's Installation Manual.

B. National Electrical Code (NEC) for US installations; Canadian Standards Association (CSA) for Canadian Installations. (Current Editions).

C. Requirements of the "Authority Having Jurisdiction".

D. All GutterMelt® SR Cable Heaters shall be approved to CSA and UL Standards as part of the system for keeping water drainage paths clear and to avoid ice dams on roof eaves, gutters, and downspouts.
   1. Constant Wattage cables are not acceptable for this application.
   2. Cables not able to withstand maximum exposure temperature of 185ºF are not acceptable for this application.

E. Enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. In order to ensure the most reliable electrical connection and to simplify the maintenance and troubleshooting of freeze protection systems only crimp connections are acceptable.

1.4 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's technical product data and written installation instructions for the roof and gutter heat trace system.

B. Shop Drawings:
   1. At architect's request, submit drawings showing layout of system relay or contactor panel, activation device, grounding connections, and heating cables required to provide complete operating system. Including the following:
      a. Locations for activation devices.
      b. Locations of relay panel, contactor panel, junction boxes, feeder wires, and load wires.
      c. Circuit feeder runs from relay or contactor panel / junction box to heating element connection points.
      d. Connection points between circuit feeders and heating element.
      e. Wiring between relay panel and activation device.
      f. Location of aerial or roof and gutter temperature moisture sensor(s).
      g. Differentiate between:
         1) Control wiring.
         2) Heating element.
         3) Cold Lead.
         4) Branch-circuit wiring.
      h. Differentiate between zones of heating element.

C. Operation and Maintenance Data: Submit manufacturer's written maintenance and operation instructions for system.

D. Warranty: Submit copy of system manufacturer's standard warranty for system.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Firm regularly engaged in manufacturing of electric cable heating elements, of type, sizes, and ratings required, whose products have been in satisfactory use in similar services for not less than five years.

B. Installer Qualifications:
   1. Licensed Electrical Contractor with a minimum of two years successful certified experience installing projects utilizing electric heating cable systems equal to systems specified in this section.

C. Regulatory Requirements:
   1. Comply with applicable local electrical code requirements of local authorities having jurisdiction.
   2. Provide products that are listed or recognized and labeled by Nationally Recognized Testing Laboratory (NRTL) that includes, but not limited to :
      a. ETL subsidiary of Intertek.
      b. Canadian Standards Association (CSA).
      c. Underwriters Laboratories (UL).
   3. Conform to requirements of "Standard for Safety Electric Space Heating Cables" (UL – 1673, 3rd Edition, dated September 13, 2010)

4. Conform to requirements of “Roof and Gutter De-icing Cable Units Issue Number 4” (UL Subject 1588, dated May 24, 2002)
5. Conform to “Requirements for Electrical Resistance Heating Cables and Heating Device Sets” (CSA – 22.2, No 130, 3rd Edition, dated January 2008)

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle in accordance with manufacturer’s written instructions. Store materials in dry indoor location off the ground.

B. Remove damaged materials from job site and replace with new at no additional cost to owner.

1.7 WARRANTY

A. Provide the Manufacturer Standards with following requirements:
1. GutterMelt® SR Cable heating element: 10 year
2. Relay Panel, Contactor Panel, and Activation device: 1 year

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Heatizon Systems, 4137 South 500 West, Murray, Utah 84123 (877) 877-4724 www.warmquest.com – shawn@warmquest.com
B. Substitutions: Not Permitted.

2.2 COMPONENTS

A. Heating Element:
1. GutterMelt® SR Cable and all accessories shall be supplied by Warmquest (Tel: 877-877-4724, Fax: 801-747-3139)
2. Shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a Radiation Cross-Linked Polyolefin Core that varies its power output to respond to temperature along the entire length, allowing the heating cable to be cut to length in the field. The core is surrounded by a liner then a Radiation Cross-Linked Modified Polyolefin Jacket covers the heating cable core and liner. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a Tinned Copper Braid (-C), as required by Article 427.23(A) of the NEC-2011. An ultraviolet stabilized weatherproof over-jacket composed of: Modified Polyolefin shall cover the grounding braid. The cable shall be suited for use on concrete, wood, plastic, rubber, metal, and asphalt building materials.
3. For energy efficiency and in order to provide heat output that is sufficient for de-icing, the heating cable shall have a nominal rating, in correlation with selection of the heating cable, of 12 watts per lineal foot in water at 32ºF.
4. The heating cable shall operate on line voltages of 208 volts.
5. Power connection, end seal, splice kit, and tee kit components shall be supplied by Heatizon Systems and applied in the field.
6. A ground-fault device for equipment protection, rated at 30-mA trip, shall protect heating cable circuit. This requirement is in accordance with Article 426 of the NEC-2011.

B. Relay Control Panel or Contactor Panel
1. Heatizon M330 Relay Panel Control Series
a. M330G Series Relay Panel accommodating eight (8) 30A resistive poles with built in Ground Fault Equipment Protection and manual activation switches and pilot light operational indicator.

C. Activation
   1. All GutterMelt® SR Cable circuits shall be activated by a Heatizon Systems approved activator for GutterMelt® SR Cable:
      a. Thermostatic Control:
         1) M336 temperature sensor controller. The system shall be controlled by an adjustable ambient sensing thermostat.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas where heating element is to be installed for proper installation, cleanliness, and conditions that may hinder successful installation of GutterMelt® SR cable system.
   1. Notify Contractor in writing of items needing correction.
   2. Do not install GutterMelt® SR cable system until faulty conditions are corrected.

3.2 INSTALLATION

A. Interface with Other Work: Coordinate installation of GutterMelt® SR cable system with appropriate sections of Division 26 Electrical.

B. The current Heatizon GutterMelt® SR Cable Installation Manual shall be considered as part of this specification.

C. The heating cable shall be laid in gutters; shall be suspended in downspouts either as a loop or a single length and held in place by a downspout hanger; and shall be attached to the roof using the roof clips.

D. All terminations shall be protected from the weather and from physical damage and bonded to the system ground.

E. The heating cable shall be protected from damage and installed according to manufacturer's instructions.

F. Any field alternations or deviations shall proceed only after authorization has been issued by engineer. All changes shall be accurately recorded by the contractor and shall be turned over to the engineer upon completion of the heating system scope of work.

3.3 FIELD QUALITY CONTROL

A. Testing as directed by system manufacturer.
   1. Field testing of insulation resistance and continuity of the units shall be carried out with a 2500VDC Megohmmeter insulation tester and recorded by the Electrical Contractor.
   2. Testing shall be performed by the Electrical Contractor done in the following order:
      a. Prior to Installation of GutterMelt® SR Heating Cable (when removed from package).
      b. After Installation of GutterMelt® SR Heating Cable on roof, gutters, drains, or downspouts.

3.4 RESISTANTANCE RECORDING

A. Insulation resistance shall be consistently not less than 20 megohms during each test.

B. A complete system startup shall be performed to verify successful operation.

C. Resistance readings shall be recorded in the GutterMelt® SR Cable Design and Installation Manual

3.5 DEMONSTRATION

A. Provide adequate demonstration and training to Owner in operation and maintenance of system.

END OF SECTION 260810

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SECTION 26 5100

INTERIOR AND EXTERIOR BUILDING LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to interior and exterior building lighting.

1.2 SUMMARY

A. This section provides general requirements for a complete and fully operational lighting system including:

1. Interior and exterior building lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Accessories
4. Light fixture support

B. Extent of interior and exterior building lighting work is indicated by drawings and schedules and is specified herein.

C. Type of lighting fixtures in this section include the following:

1. Lighting Emitting Diode (LED)

D. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 REFERENCES

A. Conform to Reference Standards by date of issue current on date of Contract Documents, except where a specific date is established by code.

1.	ANS/NFPA 70	National Electrical Code
2.	NFPA 101	Life Safety Code
3.	UL 57	Electrical Luminaires
4.	UBC Standard Section 47.1813	Luminaires
5.	IES LM-79-08	Electrical and Photometric Measurements of Solid State Lighting
6.	IES LM-80	Method for Measuring Lumen Maintenance for SSL Light Sources

B. Definitions:

1. BF: Ballast factor.
2. CCT: Correlated color temperature.
3. CRI: Color-rendering index.
4. HID: High-intensity discharge.
5. LER: Luminaire efficacy rating.
6. Lumen: Measured output of lamp and luminaire, or both.
7. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Comply with requirements of specification section describing Submittal Procedures.

B. The authorized manufacturer's representative for the project area shall prepare submittals for each lighting fixture type. In addition to the fixture submittals, a list shall be provided identifying the manufacturer representative for each fixture type. Provide manufacturers' names, addresses, and telephone numbers. Requests for prior approval shall also include this information. Submittals or requests for prior approval without this information will be rejected.

C. Product Data shall indicate that light fixture lamps, and ballasts fully comply with contract documents. Data shall be submitted for each type of light fixture indicated, arranged in order of fixture designation. For standard catalog fixtures provide original product catalog sheets indicating data on features, accessories finishes, and the following:

1. Materials and dimensions of luminaires.
2. Photometric data, in IESNA format, based on certified results of laboratory tests complying with IESNA Lighting Measurements Testing & Calculation Guides of each lighting fixture type, outfitted with lamps,and accessories identical to those indicated for the light fixture as applied in the Project.

    a. Photometric data shall be certified by a qualified independent testing agency.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

3. Low voltage transformers.
4. LED power supplies.
5. Types of lamps, including manufacturer, wattage, Color Rendering index (CRI), Color Temperature in degrees Kelvin (K), color shift over life, and efficacy (lumens/watt).
6. Air and Thermal Performance Data: For air-handling light fixtures, furnish data required in "Submittals" Article in Section "Diffusers, Registers, and Grilles."
7. Sound Performance Data: For air-handling light fixtures, indicate sound power level and sound transmission class in test report certified according to standards specified in Section "Diffusers, Registers, and Grilles."

D. Shop Drawings shall:

1. Show details of nonstandard or custom fixtures.
2. Indicate dimensions, weights, methods of field assembly, components features, and accessories.
3. For custom fixtures, modified fixtures, or linear fluorescent fixtures mounted in continuous rows, submit scaled drawings prepared by the manufacturer showing all details of construction, lengths of runs, pendant and power feed locations, accessories, finished, and lists of materials.
4. Contractor to provide the manufacturer with accurate field dimensions where required.
5. Wiring diagrams, power and control wiring.

E. Wiring Diagrams shall detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

F. Product samples, complete with housing, trim, specified lamp, ballast/transformer, and 8' cord with plug shall be submitted if requested.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawing shall include reflected ceiling plans, sections, and other details drawn to scale and coordinating the following items:

1. Light fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for light fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets
    b. Speakers
    c. Sprinklers
    d. Smoke and fire detectors
    e. Occupancy sensors
    f. Access panels

B. Product Certificates shall be signed by manufacturers of lighting fixtures certifying that products comply with requirements.

C. Maintenance Data shall be provided for lighting fixtures and equipment to include in emergency, operation, and maintenance manuals specified in specifications section describing Operations and Maintenance Data.

D. Field quality control test reports.

E. Special Warranties specified in this Section.

F. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition, or quantities. Contractor shall field verify voltage and actual mounting condition and method.

1.6 SUBSTITUTIONS

A. Comply with requirements of specification section describing Product Requirements.

B. Lighting fixtures are based on the fixture types and manufacturers specified. If substitution of fixtures other than those specified is desired, product information must be submitted to the Lighting Designer/Engineer 8 days prior to the close of the bid period. No requests for substitution will be accepted after this date.

C. Substitution requests shall include all information required in paragraph 1.4 – ACTION SUBMITTALS. Requests for approval shall be accompanied by a working fixture sample (including lamps, cord, and plug). Provide the name of at least one installation where each proposed substitute has been installed for at least six months. Provide the name and telephone number of the Architect, Owners' Representative, and Lighting Designer or Engineer of record.

D. Equipment delivery lead time shall not be held as a valid reason for requesting luminaire substitution unless luminaire lead time from specified manufacturer is in excess of twelve (12) weeks. It shall be the sole responsibility of the Contractor to determine necessary equipment lead times, deliver submittals for review in a timely fashion, and place orders accordingly to ensure timely delivery.

E. When requesting a substitution, the contractor shall provide unit and extended pricing for specified luminaire, unit and extended pricing for proposed alternate, and unit and extended savings to the Owner to be realized by accepting proposed alternate. If requested, the Contractor shall provide unit pricing for each luminaire type specified to provide a baseline comparison for substitution requests.

F. If the substitution request is accepted, approval will be in the form of an addendum to the contract documents and specifications issued to all registered plan holders.

G. A maximum of two substitution requests shall be reviewed for any single fixture type. If a substitution has not been approved following this process, the Contractor shall provide the specified fixture.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation program for Energy Efficient Lighting Products.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous location shall be listed and labeled for indicated class and division of hazard by FM Global.

F. Luminaires, ballasts, lamps and other components and controls shall equal or exceed the requirements of all applicable state and/or municipal energy codes.

G. Designated manufacturers are listed to define the requirements for quality and function of the specified product. Equivalent or better products of other, unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in this section and in Specification Section 01600 – Product Requirements.

H. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Lighting Designer's/Engineer's and Architect's approval of fixtures for mockups prior to starting installation.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Remove mockups as directed.

4. Mockups evaluated on the project site may become part of the completed Work with the approval of the Owner, Lighting Designer/Engineer, and Architect if the mockup is undisturbed at the time of substantial completion.

I. Shop Drawings: Submit manufacturer's data on interior lighting fixtures. Submit dimensioned drawings of all lighting fixtures. Identify light fixtures by type and submit in alphabetical order.

1.8 COORDINATION

A. Coordinate layout and installation of light fixtures with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, AV, and partition assemblies.

B. Provide all frames, supplementary support structures, hangers, spacers, stems aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.

C. Coordination Meetings: Meet with the ceiling installer to coordinate each light fixture mounting condition with ceiling type, and to coordinate fixture layouts in each area. Meet with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all light fixtures and ductwork in all areas.

1.9 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under the provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for LED Lighting Fixtures: A warranty must be provided by the manufacturer made out to Owner for luminaires, covering repair or replacement of defective electrical parts (including light source and power supplies) within specified warranty period indicated below.

1. Warranty Period: Five (5) years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match product installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Glass and Plastic Lenses, Covers, Louvers, and Other Optical Parts: 10% or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.
2. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide light fixtures of types as indicated on drawings or as approved by addenda. Provide complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, wiring, etc. Provide all light fixtures with safety latches where applicable.

B. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chains, or safety cables.

C. Provide all light fixtures and support accessories as required for a complete system.

D. Consult architectural drawings for louvers (if any) to be provided by Division 26.

2.2 MANUFACTURERS

A. Catalog numbers specified represent the full catalogue number of the fixture. The fixture size shall correspond with the wattage indicated in the Light Fixture Schedule or the actual length of the fixture as indicated on the drawings.

B. Acceptable manufacturers and full catalogue numbers are listed. The manufacturer listed shall provide complete fixtures equaling or exceeding the written specification. Verify these requirements and order fixtures as required for a complete and fully operational installation per the contract documents and per code.

2.3 GENERAL MATERIAL REQUIRMENTS

A. Fixtures shall be free of light leaks while providing sufficient ventilation of lamps to provide the required photometric performance.

B. Lamp-holders shall hold lamps securely against normal vibration and maintenance handling.

C. Light fixtures containing lamps which require protective shielding shall be furnished with a tempered glass lens or approved unbreakable lens UL listed for the application.

D. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

E. Metal Parts shall be free from burrs, sharp corners, and edges. Metal work shall be free from tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

F. Sheet Metal Components shall be steel, unless otherwise indicated. Components shall be formed and supported to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

G. Fixture hardware to comply with the following material standards: For steel and aluminum fixtures, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fixtures, all hardware shall be stainless steel. For bronze fixtures, all hardware shall be stainless steel or bronze.

H. Doors, Frames, and other internal access shall be smooth operating, free from light leaks under normal operating conditions, and designed to permit relamping without use of tools.

I. Provide supplemental safety device or arrange doors, frames, lenses diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance, or the seating of any fixture element. Safety device shall not be visible during normal fixture operation and from normal viewing angles.

J. Luminaires provided must have means for disconnection from power during service, as required in the NEC Article 410.

K. Reflecting Surfaces of light fixtures: Minimum reflectance as follows, unless otherwise indicated;

1. White Surfaces: 85%.
2. Specular Surfaces: 90%.
3. Diffusing Specular Surfaces: 75%.
4. Laminated Silver Metalized Film: 90%.

L. Reflector cones shall adhere to the following criteria:

1. Cones designed for vertically mounted lamps shall provide a minimum of 45 degree cutoff of lamp and lamp image. Cones designed for horizontally mounted lamps shall provide a minimum of 55 degree cutoff of lamp and lamp image. There shall be no visible lamp flashing in the cone.
2. Plastic material shall not be used for reflector cones, unless otherwise specified.
3. Cones shall not be permanently fastened to the housing or ceiling and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
4. Trim shall be flush to the finished ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
5. Reflector cones shall be of uniform gauge, not less than 0.032” thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free of spin marks or other defects.
6. Manufacture cone using the Alzak process. Refer to the fixture schedule for cone color and finish (i.e. specular or diffuse) requirements. For compact fluorescent fixtures, finish shall eliminate iridescence.

M. Lenses, Diffusers, Covers, and Globes shall be 100% virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic, polycarbonate and acrylic shall be UV stabilized and shall have high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
2. Lens Thickness shall be a minimum of 0.125” unless other thickness is indicated.
3. Lenses shall have uniform brightness throughout the entire visible area.

N. Adjustable light fixtures shall have positive locking devices to fix the aiming angle. Fixtures shall be capable of being relamped without adjusting the aiming angle.

O. Each lighting fixture that has a lamp with an oval shape beam pattern or a spread lens that defines beam orientation shall contain lamp or lens locking devices to ensure that lamp or lens orientation is not disturbed during future lamp replacement or cleaning.

P. All fixtures and drivers must operate within the temperature limits of their design and as specified by Underwriter’ Laboratories, Inc. in the applications and mounting conditions herein specified.

Q. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and driver characteristics:

a. “USE ONLY" and include specific lamp type.
b. CCT and CRI for all luminaires.

R. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

S. Provide plaster frame for recessed light fixtures mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering light fixtures.

T. Provide wire guards on all open strip type fixtures.

U. Fixtures for use in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation opening. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.

V. Welding shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld spatter and welding oxides from all welded surfaces.

W. Electromagnetic-Interference Filters shall be factory installed to suppress conducted electromagnetic, interference as required by MIL-STD-461E.

2.6 LED FIXTURES

A. All Luminaires

1. Comply with IES LM79 and IES LM80 LED product testing procedures, and DOH energy Star requirements.
2. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw from such luminaires shall not exceed 0.5 watts when in the off state.
3. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
4. Color maintenance over rated life shall be within .007 of CIE 1976.
5. Luminaires shall have a minimum CRI of 80.
6. Color shall fall within 200K of specified range.
7. LED modules shall be fully replaceable without replacing the fixture.
8. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
9. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver at least 70% of initial lumens, when installed in-situ, for minimum of 35,000 hours.

B. Power Supplies and Drivers

1. Power Factor 0.90 or higher
2. Operating temperature: minimum or -20ºF (129ºC) or below when used in luminaires intended for outdoor use.
3. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
4. Output operating frequency: 120Hz.
5. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
6. Total Harmonic Distortion Rating: Less than 3 percent.
7. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
8. Primary Current: confirm primary current with Electrical Drawings.

9. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
10. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
11. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. Controller and Control System

1. System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required.
2. Contractor to ensure that external control equipment is compatible with LED control requirements.
3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
4. For control components that are part of overall area control system see electrical Dimming Controls specification.
5. For stand-alone controlled LED systems the Light Fixture Schedule.
6. Compatibility: certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.6 LAMPS

A. Lamp each fixture with the proper quantity of lamps of the type specified in the Light Fixture Schedule.

B. LED Lamps

1. See Section 2.11, LED Fixtures.

2.6 WIRING

A. All wiring shall be as required by code for fixture wiring.

B. All flexible cord wiring between fixture components or to electrical receptacles and not in wireways shall have a minimum temperature rating of 105 degrees Celsius.

C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

D. No internal wiring shall be visible at normal viewing angles.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section pertaining to General Electrical Provisions, paragraph entitled Equipment anchorage, Support, Seismic Restraint, and Bracing for fixture support and bracing.

B. Where the ceiling is of insufficient strength to support the weight of the lighting fixtures, provide additional framing from building structure to support luminaires as required. Do not support fixtures from ceiling T-Bar system.

C. Single-Stem Hangers shall be ½ –inch (13-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the luminaire.

D. Twin-Stem Hangers shall be two, ½ inch (13-mm) steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.

E. Rod hangers shall be 3/16-inch (5-mm) minimum diameter, cadmium-plated threaded steel rod.

F. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge (2.68-mm).

G. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge (2.68-mm).

H. Hook Hangers shall be integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

I. Aircraft Cable Support shall use cable anchorages, and intermediate supports recommended by fixture manufacturer.

J. Hangers for Pendant Industrial Fixtures shall be heavy duty No. 8 jack chain with hangers, “S” hooks, mounting, straps, and all required accessories for complete installation.

PART 3 - EXECUTION

3.1 GENERAL

A. Install interior light fixtures in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer’s written instructions and approved submittal materials. Install lamps in each fixture.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Drivers: Distance between the driver and fixture shall not exceed that recommended by deriver manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Mounting height indicated in drawings from finished floor to bottom of pendant light fixture or to the center of the outlet box for all mounted light fixtures unless otherwise noted. Verify mounting heights with Architect and Lighting Designer/Engineer.

E. Mounting height may also be indicated as the length of the pendant below finished ceiling.

F. Provide all necessary hanging or mounting devices and accessories for all fixtures. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.

G. Verify weight and mounting method of all fixtures prior to ordering and provide suitable support. Coordinate with General Contractor for fixtures that require additional blocking or support. Fixture mounting assemblies shall comply with all local seismic codes and regulations.

H. Refer to architectural reflected ceiling plans for coordination of light fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Architect and Lighting Designer/Engineer prior to installing any of the systems.

I. In accessible suspended ceilings, fixture wiring connection, including equipment grounding conductor, is to be through use of 72-inch flexible conduit from a rigidly supported junction box.

J. Wire per requirements of branch circuit installation. Properly ground each fixture.

K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

L. Light fixtures located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling.

M. Install fixtures with vent holes free of air blocking obstacles.

N. Contractor shall be responsible for adjusting aperture flanges or rings on all recessed fixtures to be flush with the finished ceiling. Fixture trim shall completely conceal ceiling opening.

O. Adjust variable position lampholders for proper lamp position prior to fixture installation.

3.3 FIXTURE SUPPORT

A. Comply with specifications section describing General Electrical Provisions, paragraph entitled Equipment anchorage, Support Seismic Restraint, and Bracing for fixture support and bracing.

B. Provide all necessary hanging or mounting devices for all fixtures, verify the type needed for various ceiling conditions. Plaster rings shall be provided where required.

C. Ceiling Fixture Support: Where ceiling is of insufficient strength to support weight of light fixtures installed, provide additional framing from building structure to support as required.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Electrical Contractor is to provide and install locking clips for all fixtures installed in suspended ceilings that are UL listed for the application. The locking clip is to be attached to the fixture with a sheet metal screw or similar device and secured to the main

or supporting T-bar runner to guarantee a secure installation. Clips shall be located at or near fixture corners.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
5. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Provide four slack No. 9 safety wire hangers or threaded rods for each recessed mounted fixture. Secure form corners of each fixture and fasten to structure above, independent of ceiling system. Locate supports not more than 6 inches from fixture corners.

G. Metal decking shall not be pierced for luminaire support.

H. Wall mounted light fixtures shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4 –inch toggle bolts for gypsum board walls or 1/4 –inch bolts to pre-set inserts for concrete wall.

3.4 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 LED FIXTURES

A. Adhere to manufacturer’s installation guidelines regarding proper thermal management.

3.6 LIGHTING CONTROL

A. Provide branch circuiting in coordination with lighting control requirements of specification section describing Lighting Control Equipment and as indicated on Electrical Drawings.

3.7 PROTECTION, CLEANING AND ADJUSTING

A. Protect installed and non-installed fixtures from damage during construction period.

B. Remove protective plastic covers from light fixtures and fixture diffusers only after construction work, painting and clean-up are completed. Remove, clean and reinstall all dirty lamps, reflectors and diffusers.

C. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.

D. Make final adjustment of aimable light fixtures and adjustable light settings under the direction of the Lighting Designer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.

E. Fixtures, reflectors, and accessories which are damaged, blemished or impregnated with fingerprints shall be replaced at the contractor's expense. All finishes shall be unmarred upon project completion.

3.8 FIELD QUALITY CONTROL

A. Coordinate all testing procedures and schedule with the specification section describing Commissioning Agent – Demonstration and Training. All testing is to be documented with test procedures, results and initials of witnessing personnel and submitted to Commissioning Agent.

B. Coordinate inspection and testing of Light Fixtures with specification section describing – Lighting Control Equipment.

C. Inspect each installed fixture for damage. Replace damaged fixtures and components.

D. Replace all burned out lamps or inoperative lamps at the end of construction prior to Owner occupancy.

E. Advance Notice: Give dates and times for field tests.

F. Provide instruments to make and record test results.

G. Test as follows:

1. Verify proper operation, switching and phasing of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to generator and retransfer to normal.
3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.

H. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until unit operates properly.

3.9 SPARE PARTS

A. Acrylic Diffusers: Provide a spare acrylic diffusers and/or glass for each light fixture type and one for each additional unit for each 10 fixtures. The quantity of any single type need not exceed 10.

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SECTION 27 0526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding labeling.

1.3 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. EMT: Electrical metallic tubing.

C. TGB: Telecommunications grounding busbar.

D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. Ground and roof rings.
2. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Qualification Data: For Installer, installation supervisor, and field inspector.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Result of the ground-resistance test, measured at the point of BCT connection.
b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Installer 2, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

A. Comply with J-STD-607-A.

2.2 CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Harger Lightning and Grounding.
2. Panduit Corp.
3. Tyco Electronics Corp.

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

D. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG [26 kcmils (13.3 sq. mm)] and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Chatsworth Products, Inc.
3. Harger Lightning and Grounding.
4. Panduit Corp.
5. Tyco Electronics Corp.

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products, Inc.
2. Harger Lightning and Grounding.
3. Panduit Corp.

B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, [1/4 by 4 inches (6.3 by 100 mm)] in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a [4-inch (100-mm)] clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. TGB: Predrilled rectangular bars of hard-drawn solid copper, [1/4 by 2 inches (6.3 by 50 mm)] in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

D. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with) stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brother International Corporation.
2. HellermannTyton.
3. Panduit Corp.

B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with J-STD-607-A.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 10 AWG and smaller and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.
2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Connections to Structural Steel: Welded connectors.

C. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm.)

D. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.

4. Install grounding and bonding conductors in PVC conduit sized in accordance with the NEC until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The BCT between the TMBG and the ac service equipment ground shall not be smaller than No. 3/0 AWG.

3.5 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the TMGB with insulated bonding conductor.

E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG [168 kcmils (85 sq. mm)] unless otherwise indicated.

F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

H. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

I. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

J. Electronic System Equipment: Bond equipment chassis of other electronic system equipment including fire alarm, intrusion detection, access control, and educational school intercom and program systems to the TGB or TMGB located in their respective communication rooms.

3.7 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

    a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

    a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.

D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 0526

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

B. Related Requirements:

1. Section 26 0536 "Cable Trays" for cable trays and accessories.
2. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
3. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Certificates: For equipment frames from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. Belden Inc.
3. Cooper B-Line.
4. Emerson Network Power Connectivity Solutions.
5. Hubbell Premise Wiring.
6. Leviton Commercial Networks Division.
7. Middle Atlantic Products, Inc.
8. Ortronics, Inc.
9. Panduit Corp.
10. Siemon Co. (The).
11. Tyco Electronics Corporation; AMP Products.

B. General Frame Requirements:

1. Distribution Frames: Freestanding, 2-post, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
2. Baked-polyester powder coat finish.

D. Cable Management for Equipment Frames:

1. Vertical Cable Management: Metal or plastic, 6” wide channel, front and back of each rack, with hinged cover. Metal if utilized shall be baked-polyester powder coat finish.
2. Horizontal Cable Management: Plastic with a minimum height of two rack units each, cover, end caps, front and back of each rack.

2.4 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communication Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2. Ground Bus Bar: Copper, minimum 1/4-inch-thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.5 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Subject to compliance with all requirements, installation shall be performed by one of the following:
1. Wasatch Electric
2. R & L Network Solutions
3. Cache Valley Electric
4. ARCO Electric
5. No other approved installers without written prior approval by engineer.

3.2 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

3.3 PRE-CONSTRUCTION MEETING: Attend a Pre-Construction Meeting with the Owner to review installation standards and to discuss layout of racking and equipment prior to doing any work. Pre-Construction meeting shall take place prior to the submittals.

3.4 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with the Owner IT Department and the Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with the Owner IT Department, telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

F. Seismically brace floor-mounted racks with C-channel supports extending from each rack to the wall. Refer to Section 260072, “Electrical Supports and Seismic Restraints”.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

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SECTION 271500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Cable connecting hardware, patch panels, and cross-connects.
3. Telecommunications outlet/connectors.
4. Cabling system identification products.

B. Related Requirements:

1. Section 27 1300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

H. RCDD: Registered Communications Distribution Designer.

I. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics, including the following:

    a. Patch panels.
    b. Patch cords.

5. Patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

C. Warranty documentation:

1. Include copy of final, executed warranties.
2. Contact information.

D. Data map with warranty contact information.

E. Test results.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Device Plates: Ten of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer (copper and fiber), who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1.11 WARRANTY

A. The system shall provide a 20-year warranty for applications, parts, and labor.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

D. Topology: Star Configuration.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.4 UTP CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mohawk GigaLAN 10 Augmented Cat 6A UTP or comparable product by one of the following:

1. Hitachi Cable America, Inc.
2. Superior Essex Inc.
3. Tyco Electronics Corporation; AMP Products.

B. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6A.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
b. Communications, Riser Rated: Type CMR, complying with UL 1666.

5. Provide shielded cables for all wireless access points.

6. Jacket colors:

a. Wireless Access Points: Blue.
b. CCTV: Yellow.
c. Data: Blue.
d. Lighting Controls: White
e. Energy: Green.
f. Confirm colors with the Owner prior to purchasing any cable.

2.5 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Leviton Commercial Networks Division.
2. Tyco Electronics Corporation; AMP Products.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
2. Rating: Category 6A.
3. Fully populate all patch panels, empty spaces will not be accepted.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular Category 6A receptacle units with integral IDC-type terminals.

E. Patch Cords: Provide factory-made, 4-pair cables. 80% of the patch cords shall be 36-inch (914-mm) and the remaining 20% shall be 60-inch (1524-mm) for each patch panel to patch panel connection; terminated with 8-position modular plug at each end. 120-inch (3048-mm) patch cords shall be provided at desk-top (user) locations.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall be color-coded to match color of system for circuit identification.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position Category 6A modular. Comply with TIA/EIA-568-B.1.

Workstation Outlets: One, two, or three port-connector assemblies as indicated on drawings mounted in single faceplate.

1. Metal Faceplate: Brushed Stainless steel, complying with requirements in Section 260140 "Wiring Devices."
2. For use with snap-in jacks accommodating UTP, work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Machine printed, in the field, using adhesive-tape label, clear with black letters.

2.7 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.8 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Subject to compliance with all requirements, installation shall be performed by one of the following:
1. Wasatch Electric
2. R & L Network Solutions
3. Cache Valley Electric
4. ARCO Electric
5. No other approved installers without written prior approval by engineer.

3.2 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.3 PRECONSTRUCTION MEETING

A. Attend a Preconstruction Meeting with the Owner to review installation standards prior to doing any work. Pre-Construction meeting shall take place prior to the submittals.

3.4 WIRING METHODS

A. Install cables in raceways and cable trays except within consoles, cabinets, desks, counters, and accessible lay-in tile accessible ceilings. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. Where cables are routed in accessible lay-in tile suspended ceilings, secure and support cables with J-hooks a minimum of 8 inches (200 mm) above ceilings and not more than 60 inches (1524 mm) apart; cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Install cables in open ceilings (finished and unfinished) in raceways. Where raceways are installed in finished ceilings, paint raceways to match the color of the surrounding surface.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 260110 "Conduit Raceways." Minimum raceway size is 1".
3. Comply with requirements in Section 260111 "Cable Trays."

B. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.5 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.6 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

E. Ground shields of all shielded twisted pair cables in accordance with all manufacturer's written instructions.

3.8 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: 2.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner. Provide three (3) hard copies to owner. Provide one (1) drawing in each equipment room and wiring closet and post in a prominent location. Protect with rigid frame and clear plastic cover.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-

mounted device shall be identified with name and number of particular device as shown.

b. Label each unit and field within distribution racks and frames.

3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.
4. Meet with The Owner's Telecommunications personnel and coordinate labeling requirements prior to installation.

5. For cable drop/jack for each wireless access point, provide a Kory label on the ceiling grid nearest the radio indicating the distribution rack and circuit number.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6A, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.
2) Length (physical vs. electrical, and length requirements).
3) Insertion loss.
4) Near-end crosstalk (NEXT) loss.
5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).

7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

3.11 MAINTENANCE AND REPAIR TRAINING

A. The contractor shall provide and implement a complete and comprehensive training program for all maintenance personnel. Trainer shall be a Level 2 installer.

B. This mandatory training program will provide a complete understanding of how to maintain and repair the system including but not limited to:

1. Installation.
2. Wiring.
3. Programming.
4. Administration.
5. Trouble shooting/repair.

C. All training is to be coordinated through the owner’s designated representative. As training sessions are completed, the trainer will provide the school’s administrative staff and school district’s staff a document listing all of the maintenance personnel who attended, received, and completed the training program.

D. Provide quick reference guides.

END OF SECTION 271500

SECTION 27 3100

PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bi-directional amplifiers
2. In-building service antennas
3. Outdoor donor antenna
4. Coaxial cabling
5. Couplers and splitters

1.3 DEFINITIONS

A. DAS: Distributed Antenna System.

B. BDA: Bi-directional Amplifier.

1.4 ACTION SUBMITTALS

A. Qualification Data: For Designers and Field Technicians.

B. Product Data: For each type of product indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, for the all system products.
2. Include approvals and listings, construction details, material descriptions, dimensions, profiles, and finishes.
3. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For DAS system. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, grounding, and signal wiring.

a. Identify terminals and wiring color codes to facilitate installation, operation, and maintenance.
b. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring.

2. Details of seismic restraints including mounting, anchoring, and fastening devices for the following system components:

   a. Bi-directional amplifier

   b. Antennas

3. Heat mapping layout drawings showing calculated levels, antenna and equipment locations as well as cable routing.

4. Dimensioned Outline Drawings of the Bi-directional amplifier.

D. Delegated-Design Submittal: For the public safety distributed antenna system indicated to comply with performance requirements and design criteria, including heat mapping analysis data/layouts.

1. Design Calculations / Layouts: Perform heat mapping calculations to determine system design based upon actual existing site signal strength and building construction.

2. Provide complete design including cutsheets of all proposed equipment and installation drawings showing the installation of the system to the engineer for review and approval.

1.5 APPROVAL TESTING SUBMITTALS

A. Statement of Completion: Written statement that system has been installed in accordance with approved plans and tested in accordance with the manufacturer's published instructions and appropriate NFPA 72/1221 requirements.

B. Record of Inspection and Testing. Detailed documentation of completed acceptance testing.

1.6 CLOSEOUT SUBMITTALS

A. Record Drawings. Provide complete Shop Drawing re-submittal updated to reflect actual final system installation and sequence of operation of all components.

B. Operation and Maintenance Data: For DAS to include in emergency, operation, and maintenance manuals.

1. Provide manufacturer's Owner's Operation and Maintenance Manuals with required related system warranty requirements.
2. Provide Record of Inspection and Testing.

1.7 QUALITY ASSURANCE

A. Designer and Field Technician Qualifications: Personnel trained and certified by the TRCES manufacturer as an approved technician; and as required by the AHJ, in possession of a professional engineering license, radio licensing authority license, and/or industry certification. Will be installed by competent, experienced installers in accordance with industry best practices, Authority Having Jurisdiction, and relevant codes. Contractor must have at least 5 years' experience of successful DAS installations of similar scope, size and type

B. Source Limitations for TRCES: Single vendor source to provide TRCES components as a complete code-compliant, tested and functioning TRCES.

C. Electrical Components, Devices, and Accessories: Approved by the AHJ and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Products: Specific Agency Requirements for All RF emitting devices certified by the Radio Licensing Authority.

1.8 INSTALLER

A. Approved Installers:

1. Hunt Electric. Jared Vance, 801-420-1455
2. Pierson Wireless Corp. Ross Pierson, 402-730-8638
3. Cache Valley Electric Teledata Division, Jason Dille, 801-908-4167
4. Wasatch Electric Comtech Division, Mark Varner, 801-478-2237
5. No other approved installers without written prior approval by engineer and owner.

1.9 WARRANTY

A. Installer and/or Manufacturer agrees to repair or replace system equipment and components that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BI-DIRECTIONAL AMPLIFIER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Westell PS51080 NFPA 72 Public Safety Signal Booster
2. Prior approved equivalent

B. NEMA Type 4 Enclosure for BDA and battery backup.

C. Will provide 12 hours minimum of runtime at 100% power.

D. Automatically charge while AC power is available.

E. Low battery and AC off alarm outputs

2.2 IN-BUILDING SERVICE ANTENNAS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Gamma Nu
2. ADRF
3. Galtronics

B. General: Wideband omnidirectional, multi-band type, low-profile ceiling mount, white finish.

C. Plenum application fire test listing: UL 2043.

2.3 COUPLERS AND SPLITTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CommScope
2. Westell

B. General: 50 Ohm RF couplers and splitters; bandwidth and dB rating as required by BDA performance requirements.

2.4 CONDUCTORS AND CABLES

A. Conductors: Coax Cabling. Sizes and types as recommended by system manufacturer. Plenum rated.

B. Comply with NFPA 70, NFPA 72/1221, and requirements of authorities having jurisdiction.

C. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with the most restrictive requirements of this Section and applicable Division 26 and 27 sections for the installation of low voltage electrical systems.

B. Comply with NFPA 72/1221, and requirements of authorities having jurisdiction for installation and testing of TRCES. Install all electrical wiring to comply with requirements in NFPA 70.

C. Arrange equipment cabinets, wire-ways, and conduits with adequate clearances to facilitate access for inspection, maintenance, and component replacement.

D. Install equipment cabinets with top and bottom of cabinets not more than 72 inches above finished floor and not less than 12 inches above finished floor, respectively.

E. Install battery cabinets with top and bottom of cabinets not more than 48 inches above finished floor and not less than 12 inches above finished floor, respectively.

F. Install equipment cabinets with user displays and/or controls including fire alarm control unit nodes and remote annunciators with displays and/or controls at natural user height.

G. Flush-mount equipment cabinets/back-boxes not located in designated equipment rooms.

H. Surface-mount equipment cabinets/back-boxes located in designated equipment rooms unless noted to be installed inside racks or by other methods.

I. Install outdoor donor antenna with clear view to donor site with a minimum 2-ft vertical clearance above nearby obstacles.

J. Secure outdoor donor antenna to mounting mast in accordance with manufacturer requirements.

K. Install NFPA 780 compliant lighting protection at connection to outdoor donor antenna.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways. Cables for DAS shall not be installed inside telecommunications cable tray system, but shall be provided with a separate raceway/support system. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes.

B. Comply with NFPA 70, NFPA 72/1221, and requirements of authorities having jurisdiction.

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

E. Support cables not enclosed in raceways on J-Hooks. Install, size, and space J-Hooks to comply with TIA-568-C. J-hooks may only be used above accessible lay-in ceilings.

F. Comply with DAS component’s manufacturer installation guidelines for grounding and bonding.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Color-code wires, and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

C. Comply with AHJ requirements for TRCES component identification.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance. Include all programming.
2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

C. Components installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

D. Perform visual inspections in accordance with NFPA 72/1221. Correct deficiencies.

E. Perform functional testing in accordance with NFPA 72/1221 and AHJ requirements for plotted interior building RF signal strength and/or delivered audio quality (DAQ) score. Correct deficiencies.

F. Document 100 percent satisfactory functional tests via AHJ approved report format.

G. Perform acceptance field testing. Demonstrate system operation to the satisfaction of the AHJ.

H. DAS system will be considered defective if it does not pass tests and inspections.

I. Place system into normal operating service without system faults or outstanding work.

J. Prepare test and inspection reports.

3.5 ADJUSTING

A. 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 Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain DAS system components.

END OF SECTION 27 3100

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

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SECTION 280721

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

B. System shall be UL-listed and factory mutual-approved.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 – Operation and Maintenance Data, include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

I. The disks containing fire alarm files shall be supplied to the owner. These disks shall include all information required to allow the owner to change the fire alarm program themselves. These computer disks shall contain a minimum of the following:

1. CAD drawing files of the building fire alarm map.
2. CAD drawing files of as-build fire alarm component and point-to-point connections.
3. General configuration programming.
4. Job-specific configuration programming.
5. Tutorial file on complete programming of the fire alarm system.

J. The system contractor/supplier shall provide a “Certificate of Compliance” to the Authority Having Jurisdiction in accordance with NFPA Pamphlet 72B (1986 Edition), Section 2-2.6, at the completion of operational acceptance tests, as required herein. This will be applicable to all types of fire alarm systems.

K. A complete set of CAD “as-built” drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of equipment shall be delivered to the owner upon completion of the system installation.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project. Installation shall be by personnel certified by NICET as fire-alarm Level II technician

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Heat Detectors and Duct Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers / Installers: Subject to compliance with requirements, provide products by one of the following:

Manufacturer	Installer / Telephone
Edwards Systems Technology	PST / (801) 649-6696
Fire Control Instruments	Nelson Fire Systems / (801) 468-8300
Silent Knight	Certified Fire Protection / (801) 281-0746
Simplex Grinnell	Simplex Grinnell / (801) 262-9406

B. Manufacturers for non-system smoke detectors: Subject to compliance with requirements, provide products by one of the following:

1. Gentex Corporation.
2. System Sensor.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices**:**

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.
7. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.

4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two (2) lines of forty (40) characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control command and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
   a. Initiating Device Circuits: Style D.
   b. Notification Appliance Circuits: Style Z.
   c. Signaling Line Circuits: Style 6.
   d. Install no more than 100 addressable devices on each signaling line circuit.

D. Notification Appliance Circuit: Operation shall sound in Temporal Pattern 3.

E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.
2. Capacity: Size for all finished and unfinished spaces within building plus twenty-five (25) percent ampere-hour capacity.

J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the

top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Detectors shall be two-wire type.
2. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
5. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).
3. This is the default detector type to be used on the product, unless specifically indicated otherwise.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, as indicated in drawings, or
   b. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.8 MAGNETIC DOOR HOLDERS

A. Where shown the door holders will be provided with the door hardware package.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Zone of the supervisory signal.
3. Zone of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MEETING:

A. Attend a Preconstruction Meeting with the Owner to review installation standards prior to doing any work. Pre-Construction meeting shall take place prior to submitting the submittals.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Power for the panel, battery charger, or any other device which affects the operation of the system shall be controlled through a single circuit breaker labeled, “Fire Alarm System – Do Not Turn Off.” Connect to engine generator-supported emergency circuit where available.

C. Equipment Mounting: Install wall-mounted fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260072 – Electrical Supports and Seismic Restraints.
2. Locate fire alarm control unit as directed by the authority having jurisdiction.

D. Raceway: Install fire alarm conductors in raceway. Fire alarm system conductors from different zones may be combined in common conduit. Make certain that raceway and wire quantity, size, and type are suitable for equipment supplied and is within NEC standards. No wiring other than that directly associated with the fire alarm and detection systems shall be permitted inside the fire alarm conduits. All conduit, mounting boxes, junction boxes, panels, detectors, alarm devices, etc., shall be mounted and fastened with appropriate fittings to insure positive grounding throughout the system.

E. Loop wires through each device in zone for proper supervision. Tee-taps are not permitted. Wiring splices are to be avoided to the maximum extent possible; if needed, they must be made only in junction boxes. Transposing or changing color-coding of the wires shall not be permitted.

F. Provide dust protection for installed and existing (if any) smoke detectors until finish work is completed and building is ready for occupancy.

G. Protect conductors from cuts, abrasion, and other damage during construction.

H. Minimum conductor size shall be 14 AWG, unless otherwise specified. Shielded and/or stranded conductors shall be provided where recommended by the manufacturer.

I. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

J. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

K. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

L. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

M. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

N. Audible Alarm-Indicating Devices: Install at +80 inches (2032 mm) above finished floor, but not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

O. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn at +80 inches (2032 mm) above finished floor, but at least 6 inches (150 mm) below the ceiling.

P. Device Location-Indicating Lights: Locate in public space near the device they monitor.

Q. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

R. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

S. Do not install manual fire alarm boxes close to light switches.

T. Manual alarm initiating stations shall be provided at all required building exits, boiler rooms, kitchens, and main administrative offices, and elsewhere to provide a maximum 200’ travel distance to a pull station from any point in the building.

U. Post copy of wire identification list inside fire alarm panel door and other area accessible to fire alarm service personnel.

V. The control and other panels shall be mounted with sufficient clearance for observation and testing.

W. All fire alarm junction boxes shall be identified with zone number and red paint for easy identification.

X. Mount remote multi-signialing accessory for non-system duct smoke detector in a readily accessible location and wire complete.

3.3 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 – Identification for Electrical Systems.

B. Install framed instructions in a location visible from fire-alarm control unit.

C. All fire detection devices shall be marked in nominal ½" high letters with the zone and device number (for example: a mark reading, "1-20," indicated Zone 1, Device Number 20).

D. Building Fire Map:

1. A building fire alarm map shall be supplied to the owner, indicating the exact location and address of all individual devices. Install the building map adjacent to the fire alarm panel. Provide a high-quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall have a clear center for viewing the CAD fire alarm drawing. The edges of the sign shall be colored to match the building interior. The building map shall indicate zoning by the use of five different colors, minimum.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Engineer and authorities having jurisdiction .

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions and Authority Having Jurisdiction. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions and Authority Having Jurisdiction.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions and Authority Having Jursidiction.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

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SECTION 28 0730

ACCESS CONTROL AND INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The Access Control and Intrusion Detection System shall be fully integrated and installed as a complete package by the Access/Security Control Contractor. The SMS shall be able to provide for and integrate the following subsystems:

1. Integrated Access Control.
2. Alarm Monitoring.
3. Associated Access Control and Alarm Equipment Control.
4. Multiple Language Operation
5. Access Initiated and Event Initiated Control
6. Integrated Video Badging System
7. Workstation and associated equipment as required.

B. The SMS shall be based upon a distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on a true peer-to-peer, token passing Local Area Network (LAN). The SMS shall be capable of monitoring, recording, and displaying card access activity and supervised alarm inputs/outputs on a continuous, real time basis. Each installation shall comply with local, state, and federal code requirements as applicable.

C. The SMS shall be capable of providing access control and alarm monitoring capabilities for large and small facilities. The system shall be user friendly, providing a user interface that allows for training of non- technical personnel to effectively operate and administer the system.

D. The SMS shall be designed to provide a centralized location with the ability to monitor, control, view, and communicate from a secure location within a facility.

E. System expansion capability: Minimum 25% over specified requirements.

1.2 SYSTEM CAPABILITIES

A. The following functional capabilities are considered essential for the Security Management System described in this specification:

1. Integrated Access Control
2. Intrusion Detection
3. Door Control
4. First Key Auto Unlock
5. Anti-Passback control
6. Alarm Assessment (Instructions)
7. Database Security And Encryption
8. Maps Displaying Alarm Points
9. If/Then/and/or/not functions
10. Time Scheduled Events
11. Access Control initiated events
12. Calculations
13. Windows Based, Mouse oriented operations
14. Alarm processing from remote locations

15. processing of Access Control functions for remote locations
16. Integrated Video Badging and user configurable, automatic image verification
17. Ability to Import and Export cardholder data
18. Comprehensive User Definable Reports for transactions, alarms, messages and events
19. Comprehensive User Definable Database Reports
20. Comprehensive User Definable Archiving
21. Visitor Management
22. Two Man Rule
23. Support for OPC, DDE and ODBC technologies
24. Ability to be WEB enabled

1.3 RELATED WORK

A. Door hardware. Not specifically covered under this specification.

B. Wiring / Cable Specifications. NOTE: Coaxial wiring for data communications is not acceptable.
   1. Wiring requirements are indicated on the drawings. All wiring shall in strict accordance with all manufacturers' recommendations.
   2. All other cable is to meet the following requirements as outlined below:
      a. UL Listed
      b. NEC approved
      c. Plenum rated where required
      d. All cabling shall be shielded unless specified otherwise by a card access manufacturer.
      e. As a minimum, standard 18 AWG cable shall be installed unless in direct conflict with manufacturers specifications
      f. All cabling used in the implementation of systems integration shall be in accordance with the recommendations of the manufacturer.
   3. Provide specialist personnel for the complete wiring installation. Provide cables, conduits, cable tray and ancillary equipment necessary to complete the installation. Refer to Division 26 for additional requirements.
   4. The installation contractor must be licensed in the State of Utah as a Burglar Alarm Company. The installation contractor must be an authorized dealer of the access control system. The installation contractor must be a licensed Electrical Contractor in the State of Utah.

C. Grounding

   1. Take particular attention to the grounding of equipment cases and shielded cables to eliminate noise interference and avoid electrical loops. Provide shielded cable for all communications cabling. Correctly terminate shields at ground bars and connect to the main building ground or as specified by the manufacturer.
      a. Insulate all incoming or outgoing shielded cables from control cabinet casings.
      b. Provide suitable terminals, where grounding of cable shields is required.
      c. Make provision of a through connection of cable shields for through connected communications cables.

D. Programmers

   1. Experienced in the field of security services to suit the application. Carry out the complete design and programming of the installation in the local office of the system supplier.

E. System Support

1. System support: Provide a guarantee of system support for a minimum period of six years after final completion, including provision for technical support, hardware, and spare parts. Demonstrate that the manufacturer's previous systems have not been made obsolete and that the manufacturer is committed to total and complete backward compatibility.

1.4 SUBMITTALS

A. Provide a submittal for approval prior to commencement of installation and training to include:

1. English language description of system operation.
2. Logical flow charts.
3. Building floor plans indicating all secured portals and intrusion devices.
4. Input/output point schedules.
5. A copy of the database put into logical groups that represent how information will be displayed to the user.
6. All graphics.
7. Floor plans showing location of all controllers and sensors.
8. Co-ordination drawings showing interface terminal numbers and cross-referenced wire numbers for all connections between the SMS and other equipment.
9. Details of all readers, control devices, and sensors.
10. Full details of each control station including equipment and wiring diagrams and terminal layouts.
11. Fully detailed wiring diagrams for the entire security control, monitoring and electrical cabling installation.

1.5 MATERIALS

A. Unless indicated otherwise, furnish and install at locations shown, the specified equipment to provide a completely operational Access Control/Security Management system. The following list of main items of the installation shall not be considered to be all-inclusive:

1. Readers
2. Monitors
3. Distributed Control Units (DCU's) – Main Controller
4. Door Processing Units (DPU's) – Main Door Controllers
5. Printers
6. Alarm relays
7. Miscellaneous cable, wire, associated connectors, and hardware
8. Power supplies
9. All materials and equipment shall be standard, regularly manufactured equipment.
10. All systems and components shall be thoroughly tested and proven in actual field use.
11. All system main control components shall be from one manufacturer.

1.6 Quality Assurance

A. System manufactures shall have implemented a Quality System that complies with the ISO9001 model. Factory owned System Integrators shall be able to exhibit a commitment to gaining ISO9002 accreditation or shall have an existing accreditation in place. A factory owned office that is also ISO 9001/ISO 9002 certified or an authorized distributor of the manufacturer shall install the SMS equipment. Any other installers will not be acceptable bidders for this project.

B. Evidence of the Quality System Audits may be requested.

1.7 WARRANTY PERIOD

A. General: Provide maintenance of the system during the warranty period with the following minimum provisions:

1. Notify building owner's representative prior to performing any maintenance work.
2. The designated representative to monitor and report on equipment performance and service history, and to be a liaison with the building owner.
3. Conditions: The warranty shall cover any defects in materials and workmanship including installation and programming which shall be found during the term. This shall include any deficiencies in installation standards vis-à-vis the specifications.
4. Response: The contractor shall respond to calls for warranty service within eight working hours. Emergency service shall be obtainable within four hours of notification by the Owner. Emergency service shall be obtainable on a 24 hours basis, seven days per week.
5. Qualifications: The contractor shall utilize factory-trained technicians located within 100 miles of the job site.

B. Extended service agreement:

1. Provide a renewable annual maintenance agreement. The agreement shall provide for periodic inspections and maintenance of repair items. The agreement shall at a minimum provide for all of the terms and conditions of the warranty.

1.8 OPERATION AND MAINTENANCE DATA

A. Operation Manuals: The contractor shall deliver six composite “Systems Operation and Maintenance” manuals in three-ring binder form or bound handbook form, sized to hold the material below. Each manual shall contain, but not be limited to:

1. A Statement of Guarantee including date of termination and the name and phone number of the person to be called in the event of equipment failure.
2. A set of operational procedures for the overall system that includes all required customer activities that allow for customer operation of all system capabilities. This procedure shall fully address all customer- established system operating objectives.
3. Individual factory-issued manuals, containing all technical information on each piece of equipment installed. In the event such manuals cannot be obtained from a manufacturer, it shall be the responsibility of the contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals and information. All manuals shall be printed to ensure their permanence. No “blue line” type of reproduction is acceptable.
4. Provide six sets of manuals to include:
   a. Updated functional specification.
   b. Specification sheets and technical brochures on all equipment.
   c. Fault finding literature.
   d. Listings and description of application programs.
   e. Programmer's manual.
   f. Operator's manual including schedules of alarms, parameters, status, analog indicators, circuit diagrams, etc.
   g. Drawings.
   h. Commissioning data.

B. Maintenance Pricing: Provide a SEPARATE, fixed price for comprehensive maintenance of the complete SMS system from date of completion of the Warranty Period for the required period.

C. The Owner has the option of accepting or rejecting the proposal. The proposal will be used to evaluate the successful bidder. The proposal provides:

1. Preventative or routine maintenance as required after the Warranty Period.
2. All labor and materials for repair or replacement of defective equipment as required after Warranty Period
3. 24 hour, seven days a week breakdown service with a maximum of 24 hours response time.
4. A designated representative to monitor and report on equipment performance and service history and to be a liaison with the building owner.
5. Continuity of service personnel.
6. Provision and installation of software revisions.

1.9 OWNER'S TRAINING

A. The contractor shall supply personnel to train key customer personnel in the operation and maintenance of the installed system. The training program shall be designed to provide a comprehensive understanding and basic level of competence with the system. It shall be sufficiently detailed to allow customer personnel to operate the system independent of any outside assistance.

B. On-line context-sensitive HELP screens shall be incorporated into the system to further facilitate training and operation.

C. The training plan shall include detailed session outlines and related reference materials. The customer personnel shall be able to utilize these materials in the subsequent training of their co-workers.

D. Training time shall not be less than a total of 16 hours, and shall consist of:

1. 8 hours during normal day shift periods for system operators. Specific schedules shall be established at the convenience of the customer.
2. 8 hours of system training shall be provided to customer supervisory personnel so that they are familiar with system operation.
3. The specified training schedule shall be coordinated with the customer and will follow the training outline submitted by the contractor as part of the submittal process.

1.10 EXTRA MATERIALS

A. Based upon the contractor's and the manufacturer's experience with the equipment's performance history, the contractor shall submit a final spares list for all functions for this system. This list shall be based upon a philosophy of maintaining a central system operation with a simple remove/replace capability. The final spares list shall be developed as a result of a joint customer/contractor review of the recommended list during the installation phase. Submit this final recommended spares list for approval prior to system completion, so that spares are available upon activation.

B. As a minimum, provide:

1. Adequate response time
2. Adequate spare parts, to complete repairs within 48 hours of arrival at the job site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers / Installers: Subject to compliance with requirements, provide products by one of the following:

Manufacturer	Installer / Telephone
Schneider Electric	Utah Yamas / (801) 990-1950

B. A complete access control and intrusion detection system shall be provided in accordance with Architectural & Engineering specifications SX-SRVR dated June 2018 for Schneider Electric Security Expert.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation contractor must be an authorized dealer of the access control system. The installation contractor must be a licensed Electrical Contractor in the State of Utah.

B. Install all devices in locations as shown on the drawings in accordance with standard industry practice.

C. Install and adequately support fixed wiring throughout the installation. For cabling routes not specified in detail, submit a proposed route layout. Install bulk cable runs from switchboards to SMS panels in metal ducts.

D. Handling cables: Handle cables to avoid damage to insulation and sheathing. Report any damage and replace or repair damaged cable as directed.

E. Straight-through joints: Unless unavoidable due to length or difficult installation conditions, run cables for their entire route length without intermediate straight-through joints. Where straight-through joints are used contain within a junction box arranged so that they are accessible after installation.

F. Tagging: Identify all cables at each end and at crowded intermediate points by means of stamped, non-ferrous tags, clipped around each cable.

G. Segregation: Physically segregate data cabling from power and SMS input/out cabling and mains cabling from all other cabling.

H. Panels

1. Install panels and controllers within a dedicated metal enclosure.
2. Documentation: Provide plastic fade-free points list in a pocket. Include terminal numbers, point addresses and short and long descriptions.
3. Small point controllers: Install adjacent to the controlled device, accessible for maintenance. Provide suitable enclosure.

3.2 PRECONSTRUCTION MEETING:

A. Attend a Preconstruction Meeting with the Owner to review installation standards prior to doing any work. Pre-Construction meeting shall take place prior to submitting the submittals.

3.3 WIRING METHODS

A. Install cables in raceways and cable trays except within consoles, cabinets, desks, counters, and accessible lay-in tile accessible ceilings. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. Where cables are routed in accessible lay-in tile suspended ceilings, secure and support cables with J-hooks a minimum of 8 inches (200 mm) above ceilings and not more than 60 inches (1524 mm) apart; cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Install cables in open ceilings (finished and unfinished) in raceways. Where raceways are installed in finished ceilings, paint raceways to match the color of the surrounding surface.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 260110 "Conduit Raceways." Minimum raceway size is 1".
3. Comply with requirements in Section 260111 "Cable Trays."

B. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: 2.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration, including optional identification requirements of this standard.

D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner. Provide three (3) hard copies to owner. Provide one (1) drawing in each equipment room and wiring closet and post in a prominent location. Protect with rigid frame and clear plastic cover.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.
4. Meet with Davis School District Telecommunications personnel and coordinate labeling requirements prior to installation.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 TRANSMISSION SYSTEMS

A. The SMS shall utilize the above LAN architecture to allow all of the Control Units to share data as well as to globalize alarms. The Controller LAN shall be based upon a peer-to-peer, token passing technique with a data speed of not less than 19.2 Kb. Systems which require a "master" communications controller or network manager for the Controller LAN are not acceptable.

B. To ensure high throughput, data transmission shall use "packetized" communization techniques, such that dozens of "messages" are contained in each "packet".

C. The "turnaround time" for a global point to be received by any node, including operator stations, shall be less than three seconds.

D. Fiber Optic Pathways: If required, fiber optic media shall be used between buildings for the Controller LANs. Wherever the optical fiber enters or leaves the building, provide a fiber to hard copper interface device. The FOI shall regenerate data prior to transmitting this data to either the fiber or hard copper channels, so as not to result in the degradation of signal and to minimize the accumulation of errors between multiple FOIs. The FOI shall include "jabber" protection, such that continuous data from a defective component will not destroy communications on the LAN. Provide visual indication of receiving and transmitting data activity on the hardwired drop. Provide visual indication of data transmission on the fiber media, jabber presence on fiber and hard copper channels, and bad signal quality on the hard copper channel.

3.9 COMMUNICATIONS

A. Utilize an established LAN or other communication standard to link all SMS equipment.

B. Technique: Token Passing network for Controller LAN, Polled for Small Point & Application Specific Controllers..

C. Configuration: A break in the communication path of the Controller LAN shall be announced as an alarm and shall automatically initiate a Controller LAN reconfiguration such that the resulting sections of the Controller LAN continue to function as separate LANs. No loss of control shall result from such a break in the Controller LAN.

D. Data corruption: Check all data and retransmit if corruption has occurred. Provide adequate buffering to ensure that important data is not lost.

E. Commercial LAN: Workstations on the Controller LAN may also reside on a higher tier "commercial" LAN. This "commercial" LAN shall be based upon Ethernet, and comply with IEEE 802.3 standards. Where a "commercial" LAN is implemented, it shall be possible to connect multiple Controller LANs together, with global data sharing across this commercial LAN.

F. An operator at a workstation on the "commercial" LAN may connect to any other

workstation on the "commercial" LAN as if the operator were sitting at the other workstation.

G. Alarms and special event notices shall be routed to different workstations on the "commercial" LAN-based upon time of day, and day of the week.

H. Operator password assignment shall be available on both a system-wide basis and a workstation by workstation basis.

3.10 TESTING AND COMMISSIONING

A. GENERAL

1. The contractor shall perform all tests submitted in the “Test Procedure” section as outlined in the specification.
2. Provide a program for the testing and commissioning procedure. Use a qualified representative of the SMS supplier to co-ordinate testing and present at all tests and training courses and remain on-site until the SMS is fully operational.

B. FACTORY TESTING

1. Procedure: Submit procedure for factory test at least two weeks prior to the test.
2. Demonstration: Demonstrate each control loop including all calculations and global functions. Simulate analog values with potentiometers if required. Allow for attendance by three persons nominated by the Owner.
3. After test: Submit summary of results and necessary modifications.

C. SITE TESTING AND COMMISSIONING

1. Carry out the following:
   a. Testing and commissioning of all SMS panels separately before connecting to the network.
   b. Attendance at the testing of all equipment that interfaces to the SMS and confirmation of the operation of such equipment from the SMS interface terminals.
   c. Testing and calibration checks of all installed controllers, actuators and sensors by actual operation of the devices.
   d. Testing of all field wiring from terminals to field interface terminal strips.
   e. Testing and commissioning of all power supplies and batteries.
   f. Verification of communication to remote systems.
   g. Testing of the operation of each control point from the operator's workstation (if supplied) and verification of the status of all points and alarm functions on graphic displays.
2. Demonstrate the following:
   a. Operation of each control loop.
   b. Calibration of sensors.
   c. Globally transferred information such as alarms.
   d. Detection and action of all alarm conditions.
   e. Communications with PC workstations.
   f. Time schedules and after-hours operation.
   g. Mapping of system points to operator's workstation(s).
   h. Operator's workstation software.
   i. Power fail re-start.
   j. Essential power mode operation.
   k. Fire mode of operation.
   l. Telecommunication facilities.

D. FINAL ACCEPTANCE TEST:

1. After the testing report and as built drawings have been approved by the customer's representative, the completed system shall be tested in the presence of the customer's representative.
2. Acceptance of the system shall require a demonstration of the stability of the system. Should major equipment failure occur, the contractor shall replace or repair component (s). This test shall not start until the customer has obtained 30 days beneficial use of the system.

3.11 NOTICE OF COMPLETION

A. When the final acceptance test described above has been satisfactorily completed, the contractor shall issue a letter of completion to the customer indicating the date of such completion. The notice of completion shall be recorded by the contractor upon receipt of the customer completion letter. This date of record shall be the start of the one-year guarantee period.

END OF SECTION 27 0730

SECTION 282300

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes a video surveillance system consisting of cameras and data transmission cabling. Provide Communications Horizontal Cabling for all video surveillance cameras. Refer to Section 27 1500, “Communications Horizontal Cabling”.

B. Video management software.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts’ group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

B. Map: Facilities Project Manager will provide with a pdf map of the building to the Installer. Installer shall add labels to the map per Owner's standards, identifying the location of each camera, and return completed map in electronic pdf form back to the Project Manager.

C. Spreadsheet: Facilities Project Manager will provide with an Excel spreadsheet to the Installer. Installer shall fill out all requested information and return electronic spreadsheet file to back to the Project Manager.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NECA 1.

C. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Interior, Controlled Environment: System components installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.
2. Interior, Uncontrolled Environment: System components installed in non-air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, type 12 enclosures.
3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick. Use NEMA 250, Type 3R enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Refer to the electrical drawings for specified equipment.

B. Installer is to be an authorized reseller/integrator and must be certified for the products specified.

C. Bidding Requirements: All integrators bidding video surveillance shall break-out video surveillance separately from all other systems including fire alarm, access control, and intrusion detection. Integrators not complying with this requirement may be disqualified.

2.2 SYSTEM REQUIREMENTS

A. Surveillance cameras and system shall be IP-based with transmission via a computer network and the Internet.

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor's entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 26 0289, "Surge Protective Devices."

2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Provide UL 497 Listed primary solid-state protector for all conductive communications paths entering or leaving a building as close as possible, but no more than 50 feet, from the cables' point of entrance.

C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

B. Examine roughing-in for LAN, WAN, and IP network before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PRECONSTRUCTION MEETING: Attend a Preconstruction Meeting with the Owner to review installation standards prior to doing any work. Pre-Construction meeting shall take place prior to the submittals.

3.3 WIRING

A. Install cables in raceways and cable trays except above lay-in tile accessible ceilings. Install cables in raceway where routed in consoles, cabinets, desks, and counters. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. Where cables are routed above accessible lay-in tile suspended ceilings, secure and support cables with J-hooks a minimum of 8 inches (200 mm) above ceilings and not more than 60 inches (1524 mm) apart; cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Install cables in open ceilings (finished and unfinished) in raceways. Where raceways are installed in finished ceilings, paint raceways to match the color of the surrounding surface.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements in Section 26 0110 “Conduit Raceways.” Minimum raceway size is ¾”.
3. Comply with requirements in Section 26 0536 “Cable Trays.”

B. Conceal raceway and cables except in unfinished spaces.

C. In open ceilings and unfinished spaces, install wiring in exposed raceway.

D. Refer to Section 26 0110, “Conduit Raceways” for conduit raceways and Section 26 0536 “Cable Trays”.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

F. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

G. For LAN connection and copper communication wiring, comply with Section 27 1500 "Communications Horizontal Cabling". Use UL-listed plenum cable throughout the entire system.

H. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.4 VIDEO SURVEILLANCE SYSTEM INSTALLATION

A. Install cameras and infrared illuminators level and plumb.

B. Install cameras with 84-inch- (2134-mm-) minimum clear space below cameras and their mountings or as otherwise indicated on drawings. Change type of mounting to achieve required clearance.

C. Identify system components, wiring, cabling, and terminals according to Section 27 1500 "Communications Horizontal Cabling."

D. Add cameras to VMS Software:

1. Work directly with the Owner’s IT Department to ensure cameras are configured in Milestone according to Owner’s Standards.
2. Sign-off in writing, with the Owner’s Facilities Project Manager and personnel that all camera views are acceptable.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:

    a. Prepare equipment list described in "Informational Submittals" Article.
    b. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
    c. Set and name all preset positions; consult Owner's personnel.
    d. Set sensitivity of motion detection.
    e. Connect and verify responses to alarms.
    f. Verify operation of control-station equipment.

3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

D. Video surveillance system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Update cameras with the latest recommended firmware.

G. Label physical camera according to Owner’s Standards.

3.6 ADJUSTING

A. 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 Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.7 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows and lenses.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

3.9 TRAINING

A. Basic end-user training will be provided for all surveillance system equipment and software at no additional cost.

B. Provide information to the Owner regarding surveillance system equipment training along with respective details and associated costs.

END OF SECTION 282300

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DIVISIONS 29 – 30

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DIVISION 31 – EARTH WORK

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DIVISION 32 – EXTERIOR IMPROVEMENTS

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SECTION 32 12 16.13
PLANT-MIX BITUMINOUS PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Place a bituminous concrete pavement base course, leveling course, surface course, overlay course, or an inlay course.

1.2 REFERENCES

A. **AASHTO Standards**:

R9	Acceptance Sampling Plans for Highway Construction.
TP68	Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method.
T324	Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA).

B. **ASTM Standards**:

D979	Sampling Bituminous Paving Mixtures.
D1188	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
D2041	Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.
D2725	Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
D2950	Density of Bituminous Concrete In Place by Nuclear Method.
D3549	Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
D3665	Random Sampling of Construction Materials.
D5361	Sampling Compacted Bituminous Mixtures for Laboratory Testing.
D6927	Marshall Stability and flow of Bituminous Mixtures.

1.3 DEFINITIONS

A. Must Grind: Defined in Section 32 01 31.

B. Road Class: Defined in Section 32 01 31

1.4 SUBMITTALS

A. **Before Delivery**: Submit 48 hours before delivery:

1. Location and name of bituminous concrete production facility.
2. Mix design method.
3. Mix identification number or code.

4. Type, grade, and weight of binder.
5. Type, grade, and weight of aggregate.
6. Traffic control plan, Section 01 55 26.
7. Type and number of rollers.
8. Manufacturer's certificate of compliance for paving geotextiles. (Refer to Section 31 05 19).
9. Certification of profilograph and profilograph operator.
10. Cold weather paving plan.

B. **At Delivery**: For each batch delivered to site identify:
1. Date and project description.
2. Producer and plant.
3. Name of contractor.
4. Serial number of ticket.
5. Mix identification number or code.
6. Truck number and time dispatched.
7. Volume of mix delivered.

C. **After Placement**: Before final payment submit summary report describing profile deviation and profile roughness. See Section 32 01 31.

1.5 .**QUALITY ASSURANCE**

A. Do not change aggregate source or binder grade until ENGINEER accepts new source and new mix design.

B. Reject product and work that does not meet requirements of this Section.

C. Remove product found defective after installation and install acceptable product at no additional cost to OWNER.

D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

E. If requested, submit a quality control and testing report describing source and field quality assurance activities performed by CONTRACTOR and Suppliers.

F. For all equipment and hand tools used to mix, haul, and place the bituminous concrete, use a release agent that does not dissolve asphalt and is acceptable to ENGINEER.

1.6 **WEATHER**

A. Temperature:
1. April 15 to October 15: Place pavement when air temperature in the shade and the roadway surface temperature are above 50 deg F. The ENGINEER determines may provide written approval if it is acceptable to place outside of this temperature limit.
2. Before April 15 and After October 15: Provide a Cold Weather Paving Plan. ENGINEER must accept the plan before proceding.

Include the following details.

a. Haul details.

b. Placement details.

c. Compaction aids used in production.

d. Coordination procedure for acceptance testing.

B. Moisture: Do not place on frozen base, during adverse climatic conditions such as precipitation, or when roadway surface is wet or icy.

1.7 **NOTICE**

A. Follow Laws and Regulations concerning when and to whom notices are to be given. Send written notice at least three (3) days before start of paving.

B. Indicate paving time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on specified day, send a new notice.

1.8 **ACCEPTANCE**

A. **General**:

1. Acceptance is by Lot.
2. If non-complying material has been installed and no price for the material is specified, apply pay adjustment against cost of work requiring complying material as part of its installation, Section 01 29 00.
3. Dispute resolution, Section 01 35 10.
4. Opening a paved surface to traffic does not constitute acceptance.
5. Observation of CONTRACTOR's field quality control testing does not constitute acceptance. Such testing; however, may be used by ENGINEER for acceptance if requirements of Section 01 35 10 are met.

B. **Mix Material**: Accepted as specified for bituminous concrete , Section 32 12 05, or rubberized asphalt concrete, Section 32 12 08.

C. **Mix Temperature at Site:**

1. Reject mixes in the transport material exceeding the following temperatures.
   a. Hot mix, 425 deg F.
   b. Warm mix, 300 deg F.
   c. Oil sand bituminous concrete, 230 deg F.
2. Dispose of cold mix in paver hopper as thin spread underlay.

D. **Grade, Cross Slope**: Verify tolerances are not exceeded.

E. **Compaction**: Options for acceptance are 1) core density, 2) non-destructive test density, or 3) control strip density with visual observation. Use core density unless specified elsewhere. A Lot is acceptable if density tests are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with deficient sub-lot density tests may be accepted if pay is adjusted using an applicable pay factor in the following table, or accepted at 50 percent pay if a sub-lot is in Reject.

Table 1 – Compaction Pay Factors

Pay Factor	Density, in Percent Relative to ASTM D2041	
	Average	Lowest Test
0.70	More than 96	–
1.00	**92 to 96**	**89 or greater**
0.90	92 to 96	Less than 89
0.80	Less than 92	89 or greater
Reject	Less than 92	Less than 89

1. **Core Density**: This method compares the average density of cores extracted from a pavement surface to maximum theoretical density:
   a. Lot Size: One (1) day production with 1,000 square yard sub-lots or part thereof.
   b. Sampling Protocol: Use ASTM D3665 to randomly select in each sub-lot at least one (1) surface test location and one (1) longitudinal joint test location. Collect at least two (2) test samples at each test location, ASTM D5361. Samples are full depth or overlay depth in overlay construction.
   c. Testing Protocol: ASTM D2725 for core density and ASTM D2041 (Rice) for maximum theoretical density.
2. **Non-Destructive Density Testing by Gage**:
   a. Lot Size: One (1) day production with 1,000 square yard sub-lots or part thereof.
   b. Sampling Protocol: Use ASTM D3665 to randomly select in each sub-lot at least one (1) surface test location and one (1) longitudinal joint test location.
   c. Testing Protocol: ASTM D2950 (nuclear gage) or AASHTO TP68 (non-nuclear gage) and ASTM D2041 (Rice) for maximum theoretical density.
3. **Control Strip Density with Visual Observation**:
   a. Lot: One (1) day production.
   b. Sampling Protocol: Not required after rolling pattern is determined.
   c. Testing Protocol: ASTM D6927 (Marshall) and D2041 (Rice method) to determine rolling pattern for 94 percent compaction, thereafter visual examination.
4. **Compaction Dispute Resolution**:

a. CONTRACTOR:

1) Provide an Independent Testing Agency, Section 01 45 00.

2) Take two (2) supplement cores midway between deficient acceptance test locations, and midway between a deficient test location and an adjacent acceptable test location.

3) Patch core holes.

4) Conduct testing at no additional cost to OWNER.

b. ENGINEER:

1) Accept Lot at full pay if new information shows compliance, or

2) Accept Lot at pay reduction using new test information, or

3) Reject Lot.

F. **Thickness**: A Lot is acceptable if test deficiencies are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with sub-lot deficiencies greater than allowed for pay factor 1 in the following table may be accepted if pay is adjusted using one of the following applicable pay factors, or accepted at 50 percent pay if a sub-lot is in Reject.

Table 2 – Thickness Pay Factor

Pay Factors	Deficiency Limits, in Inches
1.00	0.00 to 0.375
0.90	0.376 to 0.50
0.70	0.51 to 0.75
Reject	0.76 to 1.00

1. **Lot Size**: One (1) day production with 1,000 square yard sub-lots or part thereof.

2. **Sampling Protocol**: Use ASTM D3665 to randomly select at least one surface test location and one longitudinal joint test location in each sub-lot. Collect at least two (2) core samples at each test location, ASTM D5361. Samples are full depth. Overlay construction measured only on overlay portion of core sample.

3. **Testing Protocol**: ASTM D3549:

a. Minimum Specified Thickness: A Lot specified to have minimum thickness will be accepted if all sub-lot measurements meet or exceed minimum. If thickness is deficient, additional material may be placed over the deficient thickness if there is no pavement feathering; placement matches this section's thickness tolerance; surface continues to drain; and roughness tolerance is met.

b. Actual Specified Thickness: A Lot specified to have actual thickness is acceptable if any sub-lot measurement does not exceed deficiency limits for thickness pay factor 1.00.

4. **Thickness Dispute Resolution**:
   a. CONTRACTOR:
      1) Hire an Independent Testing Agency, Section 01 45 00.
      2) Take two (2) additional cores midway between deficient acceptance test locations, and midway between a deficient test location and the next adjacent acceptable test location.
      3) Patch core holes.
      4) Conduct testing at no additional cost to OWNER.
   b. ENGINEER:
      1) Graph deficient areas by plotting new cores and original cores to define deficient areas assuming the following.
         a) The graph represents the thickness of the pavement.
         b) Thicknesses vary linearly along the pavement length from core depth to core depth.
         c) The pavement is a constant depth in the transverse direction.
      2) Accept Lot at full pay if new information shows compliance, or
      3) Accept Lot at pay reduction using new test information, or
      4) Reject Lot.

G. **Profile Roughness and Profile Deviation**: Section 32 01 31.

1.9 **WARRANTY**

A. Joints at Street Fixtures and Portland Cement Concrete Flat Work: If wider than 1/2 inch before end of the correction period seal joints with asphalt rubber or rubberized asphalt; Section 32 01 17.

PART 2 PRODUCTS

2.1 **MATERIALS**

A. Bituminous concrete, Section 32 12 05.
B. Rubberized asphalt concrete, Section 32 12 08.
C. Tack coat, Section 32 12 13.13.
D. Prime coat, Section 32 12 13.19.
E. Paving geotextile, Section 31 05 19.
F. Paving geogrid, Section 31 05 21.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Paver Machine: Use track equipment when operating on fabrics, geogrids or pavement mats hotter than 180 deg F

B. Compactors: Steel wheel static or vibratory. Use pneumatic tire roller for intermediate rolling only.

3.2 PREPARATION

A. General:

1. Locate and preserve utilities Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over the fixtures.
3. Remove vegetation from cracks, edges and joints. Sweep surface clean. Blow cracks clean. Remove leaves.
4. Fill cracks and fix Potholes, Section 32 01 17.
5. Stabilize Portland cement concrete subgrade slabs.

B. Traffic Control:

1. Implement notification and traffic control plan requirements, Section 01 55 26. Do not proceed without certified flaggers.
2. Apply temporary lane marking tape or paint after layout has been verified with ENGINEER.

C. Aggregate Base Course:

1. Verify base course is placed to grade, compacted and dampened.
2. If indicated, follow Section 31 31 19 requirements for herbicide treatment or Section 32 12 13.19 for prime coat applications.

3.3 PROTECTION

A. Trees, Plants, Ground Cover:

1. Protect trees, plants and other ground cover from damage.
2. Prune trees to allow equipment passage underneath, Section 32 01 93. Repair tree damage at no additional cost to OWNER.

B. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts from physical damage. Remove spatter, over-coat, or mar.

C. Do not discharge bituminous materials into borrow pits or gutters.

D. Protect hot pavement from traffic until cool enough not to become marred.

E. Remove saw-cut dust immediately. Protect neighborhood, storm drains and down-stream fish habitat.

3.4 TEMPORARY SURFACING

A. Place, roll, maintain, remove and dispose of temporary Pavement surfaces.

B. In sidewalk areas construct temporary pavements at least 1 inch thick and in all other areas at least two (2) inches thick. At major intersections and other critical locations a greater thickness may be required.

3.5 LINE AND GRADE CONTROL

A. Provide necessary survey stakes for horizontal and vertical control.

B. Furnish, place, and maintain supports, wire devices, and materials as required to provide continuous line and grade reference controls for placing pavement, matching existing pavement surfaces, etc.

3.6 FABRIC PLACEMENT

A. Section 31 05 19.

3.7 PAVEMENT PLACEMENT

A. General:

1. Barricade off or eliminate fall off edges.
2. Provide continuous forward paver movement so temperature 10 feet behind paver is as follows:
   a. Warm Mix Placement: 200 deg F minimum.
   b. Hot Mix Placement:

Table 3 – Minimum Pavement Temperature in Degrees F.

Air Temperature Deg F	Compacted Mat Thickness					
	3/4"	1"	1-1/2"	2"	3"	4"+
45 – 50	–	–	–	–	280	265
50 - 59	–	–	–	280	270	255
60 - 69	–	–	285	275	265	250
70 - 79	285	285	280	270	265	250
80 - 89	280	275	270	265	260	250
90 +	275	270	265	260	250	250

B. Overlays or Subsequent Lifts:

1. Allow new base pavement or new inlay pavement to cure (harden) before placing overlays.
2. Apply tack coat per Section 32 12 13.13 if inlay or sub-base Pavement surface is dirty or older than 24 hours.

C. Irregular Areas: Handwork is acceptable if specified grade, slope, compaction and smoothness are achieved.

D. Compaction:

1. Test mix placement until a compaction pattern is acceptable to CONTRACTOR. Continue random quality control testing.
2. Do not over compact or under compact.

3. Complete compaction before the following temperature are reached:
   a. 180 deg F for hot mixes.
   b. 140 deg F for warm mixes.

E. Joints:
1. Construct joints to industry standards for texture, density and smoothness.
2. Clean contact surfaces and apply tack coat. Ensure continuous bond between old and new pavements, or between successive day's work.
3. Offset longitudinal joints a minimum of 12 inches in succeeding courses and at least six (6) feet transversely to avoid a vertical joint through more than one course. In the top course restrict longitudinal joint to 1 foot either side of lane lines.
4. Prevent traffic, including construction traffic, from crossing vertical edges. Apply tack coat to vertical edges before making another pass with paver if mix has cooled to 90 deg F

3.8 TOLERANCES

A. Compaction: Target is 94 percent of ASTM D2041 (Rice density) plus or minus two (2) percent.

B. Lift Thickness: If not indicated, meet the following tolerances.

Table 4 – Lift Thickness Tolerance

Mix Design Method	Minimum	Maximum
Marshall	2 times maximum aggregate size	Not more than limits established by manufacturer of compactor equipment
Performance Grade (Superpave)	4 times *nominal* aggregate size	
NOTES (a) Thickness is measured after compaction.		

C. Smoothness:
1. Parallel to Centerline: Section 32 01 31.
2. Cross Slope: 1/4 inch in 10 feet except at cross section grade breaks.

3.9 REPAIR

A. Repair ride disturbing or unsafe butt joints. Repair expense is at no additional cost to OWNER.

B. If pavement smoothness is deficient, follow Section 32 01 31 repair requirements.

C. Corrective Action for Profile Deviations (“Must Grinds”): Grinding is acceptable. See Section 32 01 26. Apply a fog seal over grind areas. See Section 32 01 13.50. If depressions cannot be corrected by grinding, remove and replace.

D. Corrective Action for Profile Roughness Index: Grinding is acceptable. Re-profile corrected segments to verify ride index meets tolerance. Apply a fog seal over grind areas. See Section 32 01 13.50.

E. When thickness is deficient, place additional material over deficient areas. DO NOT skin patch. Mill for inlay if necessary.

F. Defective Joints, Seams, Edges: Repair.

G. Unacceptable Paving: Remove and replace.

3.10 OPENING TO TRAFFIC

A. Temperature of pavement surface is not more than 180 deg F

END OF SECTION

Sidewalk

1. GENERAL

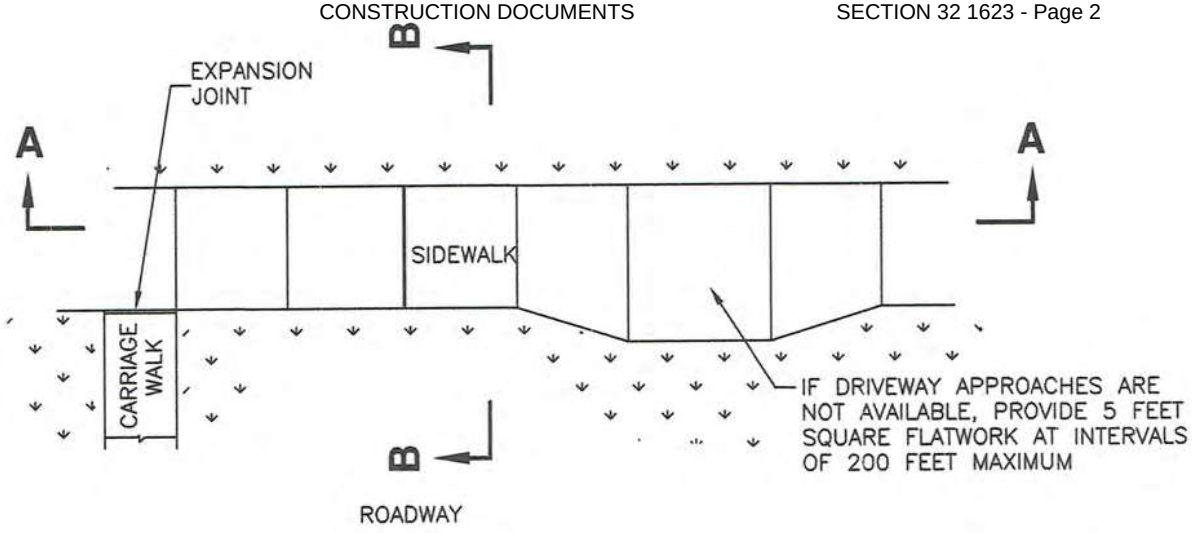
A. Variance from specified dimensions and slopes must be acceptable to the ENGINEER. System configuration may be changed at ENGINEER's discretion.
B. Additional requirements are specified in APWA Section 32 16 13.

2. PRODUCTS

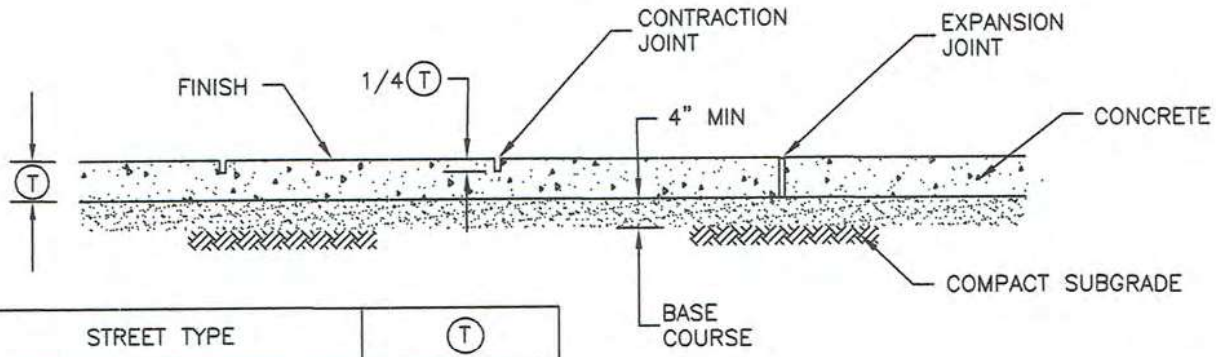
A. Base Course: Untreated base course, APWA Section 32 11 23. Do not use gravel as a base course without ENGINEER's permission.
B. Expansion Joint Filler: 1/2-inch thick type F1 full depth, APWA Section 32 13 73.
C. Concrete: Class 4000, APWA Section 03 30 04. If necessary, provide concrete that achieves design strength in less than 7 days. Use caution; however, as concrete crazing (spider cracks) may develop if air temperature exceeds 90 degrees F.
D. Concrete Curing Agent: Clear membrane forming compound with fugitive dye (Type ID Class A), APWA Section 03 39 00.

3. EXECUTION

A. Base Course Placement: APWA Section 32 05 10. Maximum lift thickness before compaction is 8-inches when using riding equipment or 6-inches when using hand held equipment. Compaction is 95 percent or greater relative to a modified proctor density, APWA Section 31 23 26.
B. Concrete Placement: APWA Section 03 30 10.
    1) Install expansion joints vertical, full depth, with top of filler set flush with concrete surface.
    2) Install contraction joints vertical, 1/8-inch wide or 1/4 slab thickness if the slab is greater than 8-inches thick. Maximum length to width ratio for non-square panels is 1.5 to 1. Maximum panel length (in feet) is 1.5 times the slab thickness (in inches).
    3) Provide 1/2-inch radius edges. Apply a broom finish. Apply a curing agent.



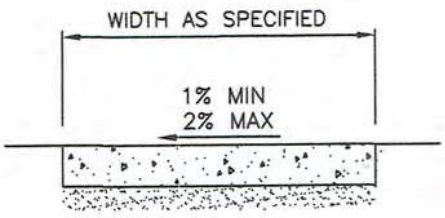
PLAN



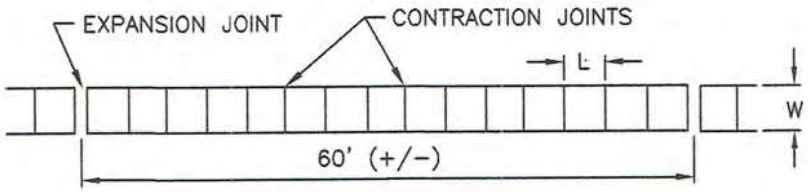
STREET TYPE	T
RESIDENTIAL (WITH PARK STRIP)	4"
RESIDENTIAL (NO PARK STRIP)	6"
OTHER	
REPLACING EXISTING SIDEWALK	MATCH EXISTING (4" MIN.)

SEE DRIVEWAY APPROACH PLANS FOR SIDEWALK THICKNESS AT DRIVEWAYS

SECTION A-A



SECTION B-B



$L_{MIN} = W$

L_{MAX} (in feet) $= 2.5 \times T$ (in inches)
OR
$= 15$ FEET MAX

SIDEWALK JOINT DETAIL

DIVISION 33 – UTILITIES

Not Used