

PROJECT MANUAL
for
Kirkwood Community College
East Hall Remodel
Cedar Rapids, Iowa

Architect Project No.: 25030

Bid Set
Issued 07.23.2026

PREPARED BY
Solum Lang Architects, LLC
1101 Old Marion Road NE
Cedar Rapids, Iowa 52402
(319) 862-0384

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**NOTICE OF PUBLIC HEARING
KIRKWOOD EAST HALL - REMODEL
KIRKWOOD COMMUNITY COLLEGE**

To Whom It May Concern:

You are hereby notified that on July 16, 2026 at 4:30 p.m. in the B.A. Jensen Board Room-Kirkwood Hall, Cedar Rapids, IA 52404, there will be a public hearing on the proposed plans, specifications, form of contract, and the estimated cost of the above named project. Any persons interested may appear and file objections to the proposed plans, specifications, form of contract, or cost of such improvement.

The following is a description and location of the Public Improvement: Remodel of Levels 1 and 2 of East Hall located on the Kirkwood Community College Campus. Scope includes exterior signage and interior remodel of existing office and shell space into new offices, conference rooms and training spaces. Updates will be made to mechanical and electrical systems. New interior construction will be drywall with steel studs, casework, floor/wall and ceiling finishes.

The location of the project is as follows:
1025 Kirkwood Pkwy SW, Cedar Rapids, Iowa

Proposed drawings, specifications, and form of contract may be examined at Kirkwood Community College, 6301 Kirkwood Blvd SW, Facilities and Public Safety Building, Cedar Rapids, Iowa 52404

Published by order of the Board of Trustees for Kirkwood Community College, Cedar Rapids, Iowa.

By: Peg Sprengeler
Title: Secretary to the Board of Trustees
Publish: July 8, 2026

X

SECTION 00 11 13
ADVERTISEMENT TO BIDDERS

1.01 PROJECT INFORMATION

- A. Notice to Bidders: Qualified bidders may submit bids for project as described in this Document. Submit bids according to the Instructions to Bidders.
- B. Project: East Hall Renovation - Kirkwood Community College
Address: 1025 Kirkwood Pkwy SW - Cedar Rapids, Iowa
- C. Owner: Kirkwood Community College
Address: 6301 Kirkwood Blvd. SW - Cedar Rapids, Iowa
- D. Architect: Solum Lang Architects
Address: 1101 Old Marion Road NE - Cedar Rapids, Iowa
- E. Project Description:
Remodel of Levels 1 and 2 of East Hall located on the Kirkwood Community College Campus. Scope includes exterior signage and interior remodel of existing office and shell space into new offices, conference rooms and training spaces. Updates will be made to mechanical and electrical systems. New interior construction will be drywall with steel studs, casework, floor/wall and ceiling finishes.

1.02 CONTRACTS FOR QUALIFICATION

- A. Larson Construction Co., Inc., Construction Manager at Risk, is requesting prequalified bidders for the above named project. Contracts will be a guaranteed maximum price between the contractor and Larson Construction Co., Inc.

Work to commence on or about September 1, 2026. See schedule for substantial complete date in contract documents. All work and equipment is to be in accordance with the plans, specifications and contract documents, which are by this reference made a part of this notice as though fully set out and incorporated herein.

Separate lump-sum bids will be received for:

- | | |
|---------------|--|
| Bid Package 1 | General Construction |
| Bid Package 2 | Aluminum and Glazing |
| Bid Package 3 | Cold Metal Framing/Drywall |
| Bid Package 4 | Suspended Ceiling Systems |
| Bid Package 5 | Tiling/Carpeting/Base |
| Bid Package 6 | Painting |
| Bid Package 7 | Fire Suppression |
| Bid Package 8 | Mechanical (Plumbing/HVAC) |
| Bid Package 9 | Electrical (Electrical/Communications/Safety and Security) |

1.03 BID SUBMITTAL AND OPENING

A. Bids shall be submitted to Larson Construction before 2:00 p.m. on August 20, 2026.

Location: 333 1st Street SE Suite 300 - Cedar Rapids, Iowa

B. Bids will be thereafter publicly opened and read aloud.

1. Bid Date: August 20, 2026
2. Bid Time: 2:00 p.m., Central Time
3. Location: 333 1st Street SE Suite 300
Cedar Rapids, Iowa
4. Log into: [Join the meeting now](#)
Meeting ID: 288 816 927 687 944
Passcode: Af2wi3vk

1.04 BID SECURITY

A. Not Required

1.05 PREBID MEETING

- A. Date: August 6, 2026
Time: 10:00 a.m.
Location: Larson Construction Co., Inc.
333 1st Street SE Suite 300
Cedar Rapids, Iowa

1.06 CONSTRUCTION BID DOCUMENTS

- A. Bidding documents may be examined at the Owner's office, Construction Manager's Office, and online or at the following location(s):
1. Rapids Reproductions: www.rapidsrepro.com
 2. ConstructConnect/MBI.Build: www.constructconnect.com
- B. Bidders are encouraged to Log On and register as a plan-holder for this project at www.rapidsrepro.com. Once bidder has completed registration, add www.rapidsrepro.com to company list of safe URL's. Once bidders have registered and logged on, bidders can access bidding documents at no charge. Bidding documents may be downloaded, viewed and printed from the website, www.rapidsrepro.com. Addenda and other project communications will be distributed to plan-holders from Rapids Reproductions. Hard copies of the Bidding Documents may be obtained from: Rapids Reproduction, Inc., 6015 Huntington Ct. NE, Cedar Rapids, IA 52402, Phone: (800) 383-1223, FAX: (319) 364-2645.
- C. One set per bidder is allowed. Additional sets may be purchased from Rapids Reproductions at cost. No deposit is required. All bidders are asked to return the complete set of Bidding Documents to Rapids Reproductions at the above address within ten (10) days after opening of

1.07 PROJECT TIMELINE

- A. Successful bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.
1. Work to begin on or about: September 1, 2026
 2. Substantial Completion: Reference Overall Schedule

1.08 BIDDER'S QUALIFICATIONS

- A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance required for their work.

1.09 TAXES

- A. Contractors using "materials, supplies, and equipment" on projects in designated "exempt entities" may purchase these items without liability for the sales tax. The contractor must have a purchasing agent authorization letter and an exemption certificate from the public entity to present to the retailer, which specifies the construction project and will be available for that
- B. Owner will issue an authorization letter and an exemption certificate to the contractor and/or subcontractors for the purchase or use of building materials, supplies, and equipment to be used on this project only. DO NOT include sales tax in your bid.

END OF SECTION

Public Notice

Request for Statements of Qualification

Subcontractor Prequalification to Bid

Larson Construction Company, Inc., Construction Manager at Risk, is requesting Statements of Qualification for the East Hall Renovation project for Kirkwood Community College, Cedar Rapids, Iowa. Contracts will be a guaranteed maximum price between the contractors and Larson Construction Company, Inc.

CONTACT INFORMATION

Please direct any questions to:

Larson Construction Company, Inc.

Attn: Ann Schwartz

Telephone: (319) 334-7061

Email: bids@larsonconst.com

PROJECT SITE

East Hall – Kirkwood Community College
1025 Kirkwood Pkwy SW
Cedar Rapids, Iowa 52404

BID SCHEDULE INFORMATION

Activity	Date	Time
Subcontractor RFQ Issue	July 7, 2026	
RFQ Due Date	July 22, 2026	2:00 p.m.
Issuance of Contract Documents	July 24, 2026	
Pre-Bid Meeting	August 6, 2026	10:00 a.m.
Bids Due	August 20, 2026	2:00 p.m.

SCOPE OF PROJECT

This is a remodel of 50,000 sf on levels 1 and 2 of east hall located on the Kirkwood Community college campus. The existing building is a 2-stories used for general Business occupancy. The project scope includes exterior signage and the interior Remodel of existing office and shell space into new offices, conference rooms and Training spaces. Updates will be made to mechanical and electrical systems including The installation of new rooftop equipment. Existing sprinkler and life safety systems Will remain in place. The new interior construction will be drywall with steel studs, Built in casework, floor, wall and ceiling finishes.

ANTICIPATED BID PACKAGES

Bid Package 1	General Construction
Bid Package 2	Aluminum and Glazing
Bid Package 3	Cold Metal Framing/Drywall
Bid package 4	Suspended Ceiling Systems
Bid Package 5	Tiling/Carpet/Base
Bid Package 6	Painting
Bid Package 7	Fire Suppression
Bid Package 8	Mechanical Complete (Plumbing/HVAC)
Bid Package 9	Electrical Complete (Electrical/Communications/Safety and Security)

SELECTION CRITERIA

Fill out attached two-page Statement of Qualifications (SOQ)
Request includes information for the following:

Company information, Qualifications, Insurance & Bonding, Legal and Safety Information

RFQ SUBMISSION

Completed RFQ form must be turned in:

EMAIL: bids@larsonconst.com by July 22, 2026, at 2:00 PM

INCOMPLETE OR LATE SUBMISSIONS

Incomplete or late submissions may be grounds for disqualification. Larson Construction reserves the right to waive any deficiencies or irregularities in any RFQ response and to determine if qualified firms are allowed to submit a proposal in the best interest and value of the Owner.

SUBMISSION RESULTS

CMaR will notify all Sub-Contractors who responded to the request for qualifications whether they successfully met prequalification criteria and are allowed to submit a bid. Subcontractors who fail to meet pre-qualification standards will be provided with information regarding which prequalification criteria were not met.

OTHER

Responding firms will bear all costs for preparation & delivery in response to this RFQ.

The Owner and Construction Manager reserve certain rights, including, but not limited to, the following:

1. Cancel the entire RFQ
2. Reject all proposals
3. Cancel the entire RFQ process and restart with modified criteria
4. Remedy technical errors in the RFQ process
5. Appoint evaluation committees to review qualifications and proposals
6. Seek assistance of outside technical experts in evaluation
7. Issue subsequent requests for proposals
8. Waive informalities and irregularities in the RFQ or subsequent RFP process



CONTRACTOR STATEMENT OF QUALIFICATIONS

Under state of Iowa bidding laws on a CMaR project, only bids submitted by prequalified subcontractors can be accepted on bid day.

Project: _____ Date: _____

Seeking Prequalification for the following work: _____

COMPANY INFORMATION

Company Name: _____

Company Address: _____

Company Website: _____

Contact Person/Title: _____

Contact Person's Email: _____

Contact Person's Cell: _____ Office Phone Number: _____

Type of Organization (Corporation, Partnership, Joint, LLC, Sole Prop.): _____

Number of Years in Business: _____ State of Iowa Contractor Number: _____

Estimated Total Value of contracts completed of like work for the last three years:

2025 _____ 2024 _____ 2023 _____

QUALIFICATIONS

Technical Competence

Does your company have an orientation program for new employees? (Yes/No) _____

Does your company have a training program or provide continuing education to your employees? (Yes/No) _____

Capacity of Personnel

Does your company have the resources (personnel, financial, etc.) to successfully complete this project? (Yes/No) _____

Do your trade workers have the capability & technical competence to successfully complete this project? (Yes/No) _____

Does your company have the experience to successfully complete this project? (Yes/No) _____

List of key personnel (Add additional pages if needed) :

Employee Name	Title/Position	Years in Trade	Work Related Skills/Tasks Performed Daily

Capability to Perform

How many full time employees does your company have? _____

What percentage of your company's total contract work over the last three years has been self performed? _____

What work does your company self perform? (Add additional pages if needed) _____



List of relevant projects similar in size and scope to this project your company recently completed:

Project Name	Architect	Contract Amount

INSURANCE & BONDING

Can your company secure the level of insurance typically required for a public project like this? (Yes/No) _____

Can your company secure payment and performance bonds for this project, if required? (Yes/No) _____

What is the name of your bonding company? _____

LEGAL

Has your company failed to complete any work under contract in last three years? (Yes/No) _____

In the past five years, has your company filed for bankruptcy or insolvency? (Yes/No) _____

In the past five years, has any company officer, partner, or principal been convicted of a crime? (Yes/No) _____

Are there any judgements, claims, arbitrations, proceedings pending/outstanding against your company? (Yes/No) _____

If yes, please describe: _____

SAFETY

Does your company have a safety program? (Yes/No) _____

Does your company comply with State and Federal Safety Regulations? (Yes/No) _____

Does your company have a full time Safety Officer? (Yes/No) _____

What is your current EMR Rating? _____

In the past three years, has your company had any OSHA citations? (Yes/No) _____

If your company has had citations within the last 3 years, please describe: _____

CERTIFICATION

The undersigned states they have carefully examined all the information provided and representations made in this Statement of Qualifications (SOQ) and certifies, to the best of their knowledge, that this SOQ is entirely complete, true, and accurate.

Signature: _____ Print Name: _____

Title/Company Name: _____ Date: _____

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Bid Submission
- B. Intent
- C. Work Identified in the Contract Documents
- D. Contract Time
- E. Definitions
- F. Contract Documents Identification
- G. Availability of Documents
- H. Examination of Documents
- I. Inquires/Addenda
- J. Product Substitutions
- K. Site Examination
- L. Prebid Conference
- M. Subcontractors/Suppliers/Others
- N. Submission Procedure
- O. Bid Ineligibility
- P. Security Deposit
- Q. Performance Assurance
- R. Bid Form Requirements
- S. Sales and Use Taxes
- T. Selection and Award of Alternatives
- U. Duration of Offer
- V. Acceptance of Offer

1.01.A BID SUBMISSION

- A. Bids for the East Hall Renovation, signed and under seal, executed, and dated will be received by Larson Construction Co., Inc. at:
 - LOCATION: Larson Construction - Cedar Rapids Office
 - ADDRESS: 333 1st Street SE Suite 300 - Cedar Rapids, Iowa
 - TIME/DATE: 2:00 p.m. on August 20, 2026
- B. Offers submitted after the above time shall be returned to the bidder unopened.
- C. Bids will be opened publicly immediately after the time for receipt of bids.

1.01.B INTENT

- A. The intent of this Bid request is to obtain offers to perform work to complete renovations at East Hall - Kirkwood Community College.

1.01.C WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

- A. Work of this proposed Contract comprises of renovation of Levels 1 and 2 of East Hall located on the Kirkwood Community College Campus. Scope includes exterior signage and interior remodel of existing office and shell space into new offices, conference rooms and training spaces. Updates will
- B. Location: 1025 Kirkwood Pkwy SW, Cedar Rapids, Iowa

1.01.D CONTRACT TIME

- A. Substantial Completion: TBD
- B. The bidder, in submitting an offer, accepts the Contract Time period stated for performing the Work.

1.01.E DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Instructions to Bidders, Information Available to Bidders, Bid Form and Securities identified.
- B. Contract Documents: Defined in latest version AIA A201 in Article 1 including issued Addenda.
- C. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.
- D. Bid Price/Sum: Monetary sum identified by the Bidder in the Bid Form.

1.01.F CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents are identified as Solum Lang Project Number 25030, as prepared by the Architect/Engineer and identified in the Project Manual.

1.01.G AVAILABILITY OF DOCUMENTS

- A. Bid Documents may be obtained as stated in the Notice to Bidders.
- B. One set of Bidding Documents can be obtained by Bidders upon receipt of a refundable deposit, cash or check in the amount identified in the Notice to Bidders.
- C. Partial sets of Bidding Documents will not be issued to Bidders.
- D. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.01.H EXAMINATION OF DOCUMENTS

- A. Bid Documents may be obtained and viewed at the office of CM which is located at 600 17th St. SE Independence, IA .
- B. Bid Documents are on display at the offices of the construction association plan room facilities indicated in the Notice to Bidders.
- C. Upon receipt of Bidding Documents verify documents are complete. Notify Architect/Engineer if documents appear to be incomplete. If using any of the listed plan rooms or online plan services listed in Notice to Bidders, or any other online plan service, Contractor shall verify they have complete documents based on those posted on official printer's website.
- D. Immediately notify Architect/Engineer upon finding discrepancies or omissions in Bidding Document:

1.01.I INQUIRES/ADDENDA

- A. Direct questions in writing to the Architect/Engineer.
- B. Addenda may be issued during the bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Amount.
- C. Verbal answers are not binding on any party.
- D. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum.

1.01.J PRODUCT SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 7 days before receipt of bids.
- B. When a request to substitute a product is made, Architect may approve the substitution and will issue an Addendum to known bidders.
- C. The submission shall provide sufficient information to determine acceptability of such products.
- D. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- E. Provide products as specified unless substitutions are submitted in this manner and accepted.

1.01.K SITE EXAMINATION

- A. Examine the project site before submitting a bid. Extra costs for work not identified on the drawings, but clearly visible, will not be considered.
- B. Contact the Construction Manager to arrange a date and time to visit project site:
Email: aschwartz@larsenconst.com

1.01.L PREBID CONFERENCE

- A. Prebid Conference is scheduled for:
August 6, 2026 at 10:00 a.m.
Location: 1025 Kirkwood Pkwy SW, Cedar Rapids, Iowa
- B. All bidders and suppliers are invited.
- C. Representatives of Architect and CM will be in attendance.
- D. Information relevant to the Bid Documents will be recorded in an Addendum.

1.01.M SUBCONTRACTORS/SUPPLIERS/OTHERS

- A. Owner reserves the right to reject a proposed Contractor for reasonable cause.
- B. Refer to General Conditions.

1.01.N SUBMISSION PROCEDURE

- A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
- B. Submit one copy of the executed offer on the Bid Form provided, signed and sealed in a separate closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.
- C. Improperly completed information may be cause not to open the Bid Form envelope and declare the bid invalid or informal.
- D. An abstract summary (bid tab) of submitted bids will be made available to all bidders following the bid opening.

1.01.O BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetic errors, erasures, alterations, or irregularities of any kind, may at the discretion of the CM, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures which are improperly prepared may, at the discretion of CM, be declared unacceptable.

1.01.P SECURITY DEPOSIT

- A. Security Deposit or Bid Bond are NOT required.

1.01.Q PERFORMANCE ASSURANCE

- A. Performance and Payment Bond are NOT required.

1.01.R BID FORM REQUIREMENTS

- A. Complete all requested information in the Bid Form and Appendices.

1.01.S SALES AND USE TAXES

- A. This is a sales tax-free construction project. Bidders shall NOT include state sales taxes in their proposals. The Owner will issue a state sales tax exemption certificate for all materials purchased for the project and will issue the appropriate tax exemption certificates and authorization letters to the Contractors and all subcontractors performing work on the project. Tax exemption certificates are applicable only for the specific project for which the certificates are issued. The Contractors shall provide a listing to the Owner of all appropriate subcontractors which are qualified to use the tax exemption certificate. The Contractors and subcontractors may make copies of the tax exemption certificate and may provide a copy to each supplier providing construction material. Materials for this contract may then be purchased free from sales tax. Suppliers shall retain this certificate for at least three years.

1.01.T SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of bid price for alternatives listed on the Bid Form. Unless otherwise indicated, indicate alternatives as a difference in bid price by adding to or deducting from the base bid price.
- B. Bids will be evaluated on the total of the base bid and accepted alternates.

1.01.U DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

1.01.V ACCEPTANCE OF OFFER

- A. Owner and/or CM reserves the right to accept or reject any or all offers and to waive any irregularities or informalities.
- B. After acceptance by Owner, Construction Manager on behalf of Owner, will issue to the successful bidders, a written Bid Acceptance.

END OF SECTION

**SECTION 00 41 00
BID FORM**

THE PROJECT AND THE PARTIES

TO: East Hall Renovation
FOR: Kirkwood Community College
DATE: August 20, 2026

SUBMITTED BY

Bidder's Full Name: _____
Address: _____
Phone: _____
Email: _____

OFFER

Having examined the Place of Work and all matters referred to in the Instructions to Bidders and in the Contract Documents prepared by Solum Lang Architects. For the above project, we, the undersigned, hereby offer to enter into a contract to perform the Work for the sum of money stated below.

Bid Package # _____ Bid Package Name: _____

Base Bid: _____ Dollars

(\$ _____) in lawful money of the United States of America.

Alternate No. 1: Exterior Signage

_____ Dollars

(\$ _____) in lawful money of the United States of America.

ACCEPTANCE

1. This offer shall be open to acceptance and is irrevocable for thirty (30) days from bid date.

SIGNATURES

(Bidder - Print the Full Name of Firm)

(Authorized Signing Officer, Title)

END OF SECTION

SECTION 00 72 00
GENERAL CONDITIONS

The Standard Form of General Conditions is the American Institute of Architects Document A201-Latest Version, General Conditions of the Contract for Construction.

END OF SECTION

x

SECTION 00 73 00.A
CERTIFICATE OF INSURANCE

See attached COI.

END OF SECTION



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 have ADDITIONAL INSURED provisions or 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 Insurance Agent Name	CONTACT NAME: Insurance Company	
	PHONE (A/C, No, Ext):	FAX (A/C, No):
INSURED Name of Insured	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	
	NAIC #	
	INSURER A:	
	INSURER B:	
	INSURER C:	
	INSURER D:	
	INSURER E:	

COVERAGES

CERTIFICATE NUMBER: 5358210

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 INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
X	COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE \$ 1,000,000
	CLAIMS-MADE ☐ OCCUR ☐						DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 100,000
							MED EXP (Any one person) \$ 5,000
							PERSONAL & ADV INJURY \$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE \$ 2,000,000
	POLICY ☐ PRO-JECT ☐ LOC ☐						PRODUCTS - COMP/OP AGG \$ 2,000,000
	OTHER:						\$
X	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000
	ANY AUTO						BODILY INJURY (Per person) \$
	OWNED AUTOS ONLY ☐ SCHEDULED AUTOS ☐						BODILY INJURY (Per accident) \$
X	HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY ☒						PROPERTY DAMAGE (Per accident) \$
							\$
X	UMBRELLA LIAB						EACH OCCURRENCE \$ 5,000,000
X	EXCESS LIAB						AGGREGATE \$ 5,000,000
	DED ☐ RETENTION \$						\$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY						X PER STATUTE ☐ OTH-ER ☐
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)	Y/N ☐	N/A				E.L. EACH ACCIDENT \$ 500,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE \$ 500,000
							E.L. DISEASE - POLICY LIMIT \$ 500,000

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

CERTIFICATE HOLDER Larson Construction Co. Inc. 600 17th Street P.O. Box 112 Independence IA 50644	CANCELLATION 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 73 00.B
SUBCONTRACT AGREEMENT

See attached Sample Standard Form of Subcontract Agreement Between Larson Construction Company, Inc. and Contractor.

END OF SECTION

Subcontract Agreement

THIS AGREEMENT, made this **DATE**, by and between **LARSON CONSTRUCTION CO., INC. (LCCI) of INDEPENDENCE, IA** hereinafter called the Contractor, and **SUBCONTRACTOR** hereinafter called the subcontractor.

Witnesseth, That for the consideration hereinafter named, the said Subcontractor agrees with said Contractor, as follows:

Section 1. The Subcontractor agrees to furnish all labor, material and equipment, necessary to perform and complete all the work for the
(Project Description)

as described in Section 2 hereof, and in accordance with the drawings, General Conditions of the Contract, Supplementary General Conditions, Specifications, Attached Exhibits and **Addenda Numbers (all)**, inclusively prepared by **ARCHITECT**.

Section 2. Scope of Work: The Subcontractor agrees to promptly begin said work within **1 day**, after notification by said contractor, and complete all work as follows in accordance with this Agreement.

Work Description:

The above Division complete per plans and specifications. This includes all material and labor for the complete job.

NOTE: This project is sales tax exempt.

Section 3. The Subcontractor shall obtain insurance in accordance with the requirements of Exhibit A and shall cause any sub-tier contractors it hires to do the same; Subcontractor shall also pay for all state and/or federal taxes, assessments, Unemployment Compensation Contributions or other charges, and acquire and pay for necessary permits and/or licenses to do business as required by law.

Section 4. No extra work, back charges or changes under this contract will be recognized or paid for, unless agreed to in writing by the Contractor and Subcontractor before the work is done or the changes made. No oral agreements will be made by either party.

Section 5. This contract shall not be assigned by the Subcontractor without first obtaining permission in writing from the Contractor. The Subcontractor shall be responsible for performance of work by his employees, agents or his Subcontractors, and the Subcontractor agrees to bind his Subcontractors to all provisions of this agreement.

Section 6. Subcontractor agrees to be bound by all terms and conditions of all provisions of the General Conditions of the contract (AIA A201 latest edition unless otherwise specified), except insofar as such conditions conflict with the requirements specifically set forth elsewhere herein.

Insofar as the provisions of the General Contract do not conflict with specific provisions herein contained, they, and each of them, are hereby incorporated into this Subcontract as fully as if completely rewritten herein. The Subcontractor agrees to be bound to the Contractor by all terms of the General Contract applicable to this Subcontract, and to assume toward Contractor, with respect to the work and all operations of Subcontractor on this construction project, all the obligations and responsibilities that Contractor by the General Contract assumes toward Owner. The Subcontractor agrees that it will so perform this subcontract as not to violate any terms, covenants or conditions of the General Contract. The relationships of the Subcontractor hereunder toward Contractor shall be the same as that of Contractor toward the Owner under the General Contract, and the relationship of the Contractor hereunder to the Subcontractor shall be the same as that of the Owner toward the Contractor under the General Contract.

Section 7. Indemnity. To the fullest extent permitted by law, the Subcontractor shall defend, indemnify and hold harmless the Owner, the Contractor and any of their respective officers, agents, servants, or employees, and affiliates, parents and subsidiaries from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the work, whether such claim, damage, loss or expense including attorney's fees accrues or is incurred during contract performance or subsequent to completion of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including but not limited to Contractor's rented, leased, borrowed or owned equipment, (other than the Work itself) including loss of use resulting there from, but only to the extent caused in whole or in part by negligent acts or omissions of the Subcontractor, and anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce the maximum indemnity obligation which would otherwise be permissible to impose on Subcontractor under Iowa Code 537A.5 as to a party or person described in this Paragraph.

In claims against any person or entity indemnified under the foregoing Paragraph by an employee of Subcontractor or anyone directly or indirectly employed by Subcontractor or anyone for whose acts Subcontractor may be liable, the foregoing indemnification obligation shall not be limited by any limitation on the amount or types of damages, compensation or benefits payable by or for the Subcontractor, including those payable under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

The Subcontractor shall indemnify the Contractor for fines, or penalties imposed on the Contractor as a result of safety violations, but only to the extent that such fines, or penalties are caused by the Subcontractor's failure to comply with applicable safety requirements, and then only to the extent that such fines or penalties are determined to be the Subcontractor's responsibility based upon the particular failure of compliance cited, and not due to prior repeated safety violations by the Contractor. In turn, the Contractor shall indemnify the Subcontractor for fines, or penalties imposed on the Subcontractor as a result of safety violations, but only to the extent that such fines, or penalties are caused by the Contractor's failure to comply with applicable safety requirements, and then only to the extent that such fines or penalties are determined to be the Contractor's responsibility based upon the particular failure of compliance cited, and not due to prior or repeated safety violations by the Subcontractor.

Section 8. Safety. The Subcontractor and Contractor agree to observe and comply with all applicable federal, state and local laws, ordinances, rules and regulations, including but not limited to the Occupational Safety and Health Act of 1970, as amended, effective where the work under this Subcontract is to be performed. Establishment of a safety program by the Contractor shall not relieve the Subcontractor or other parties of their safety responsibilities. The Subcontractor shall establish its own safety program implementing safety measures, policies and standards conforming to those required or recommended by governmental and quasi-governmental authorities having jurisdiction and by the Contractor and Owner, including, but not limited to, requirements imposed by the Subcontract Documents. The Subcontractor shall comply with the reasonable recommendations of insurance companies having an interest in the Project. The Subcontractor shall notify the Contractor immediately following an accident and promptly confirm the notice in writing. A detailed written report shall be furnished if requested by the Contractor. Subcontractor further agrees to be bound by the terms of the Larson Construction Safety Policy.

Section 9. Special Conditions:

Note: All amendments to contract must be initialed by both parties.

Note: Subcontractor must provide a certificate of insurance to LCCI before commencing any work under this agreement. See Exhibit A for requirements Subcontractor must comply with under this agreement, including documentation Subcontractor must submit in connection with such certificate(s) of insurance.

Note: All pay requests shall be in the Larson Construction office no later than the 20th of each month or the pay request will be held over for the next month's request. See Exhibit B.

Note: Adherence and execution of the Larson Construction Safety Policy is required for all contractors in addition to their own policy. An electronic copy of the safety policy is available upon request.

Note: Hard hats, high visibility clothing and safety glasses are required within construction limits. If the contractor or any of their personnel fail to comply, LCCI will inform the contractor of the situation in writing and give them a 24-hour notice to correct the situation. If the contractor fails to correct the situation, LCCI will charge the said contractor \$100/incident/employee.

Note: OSHA SAFETY REGULATIONS

Note: RIGHT TO KNOW LAWS

Note: EQUAL EMPLOYMENT LAWS

Note: A lien waiver must be signed and returned immediately upon receipt of a check sent by Larson Construction Co., Inc. Payment may be withheld until return of signed lien waiver.

Note: Clean-up and dunnage by each trade daily. Donage removed from site will be paid by each trade.

Note: If the contractor fails to keep their site clean, LCCI will inform the contractor of the situation in writing and give them a 24-hour notice to correct the situation. If the contractor fails to correct the situation, LCCI will clean and back charge the said contractor. The cleaning charges will be \$85/hour/man plus equipment rental, cleaning supplies & removal charges.

Note: Shop drawings and submittals are required 15 days after agreement is received.

Note: **Alternates Accepted Are:**

Note: **Project Substantial Completion Date:**

Note: This project is sales tax exempt.

IN CONSIDERATION WHEREOF, the said Contractor agrees that he will pay to the said Subcontractor, in **monthly** payments, the sum of **SUBCONTRACT AMOUNT** for said materials and work, said amount to be paid as follows: **ninety five percent (95%)** (five percent 5% retainage) of the value of labor and materials incorporated by Subcontractor in the work and of materials stored on the job site in an applicable manner, to be paid on the **when paid by owner** of the following month, except the final payment which the said Contractor shall pay to the said Subcontractor within **when paid by owner** after final acceptance of the Subcontractor's work by the Architect-Engineer-Contractor-Owner and said Subcontractor shall have submitted satisfactory evidence that all obligations have been paid, and said Subcontractor has filed all necessary Sales and Use Tax report forms and any other required reports.

The Contractor and the Subcontractor for themselves, their successors, executors, administrators and assigns, hereby agree to the full performance of the covenants of this agreement.

IN WITNESS WHEREOF, they have executed this agreement the day and date written above.

Larson Construction Co., Inc.

Contractor (Signature)

Ed Larson, President
(Printed Name and Title)

Subcontractor (Signature)

(Printed Name and Title)

SECTION 007301 – SUPPLEMENTARY CONDITIONS FOR AIA 201-2017

PART 1 - GENERAL

1.1 INSTRUCTIONS TO BIDDERS

- A. Instructions to Bidders for Project consist of the following:
 - 1. AIA Document A701, "Instructions to Bidders."
- B. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY CONDITIONS FOR AIA 201-2017, GENERAL

- A. The following supplements modify, change delete from or add to the "General Conditions of the Contract for Construction", AIA Document A201 - 2017. Where any article of the General Conditions is modified or deleted by these supplementary conditions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

1.3 ARTICLE 2 – OWNER

- A. Paragraph 2.3 Information and Services Required of the Owner
 - 1. Sub-paragraph 2.3.4: Add the following to the end of paragraph:

"The Contractor shall compare information furnished by the Owner (including surveys and soil tests with observable physical conditions) and the Contract Documents and on the basis of such review, shall report to the Owner and Architect any conflicts, errors or omissions."
- B. Paragraph 2.3 Information and Services Required of the Owner
 - 1. Sub-paragraph 2.3.6: Delete and add the following:

"2.3.6 The Contractor will be furnished, free of charge, returned bid set copies of Drawings and Project Manuals for execution of Work. Costs for copies of drawings and Project Manuals in excess of this number shall be the responsibility of the Contractor."

1.4 ARTICLE 3 – CONTRACTOR

- A. Paragraph 3.2 Review of Contract Documents and Field Conditions by Contractor
 - 1. Add the following language to the end of Paragraph 3.2.1

"The Contractor also represents that all Contract Documents for the Project have been examined; including those intended for work of trades not normally performed by the Contractor's own forces, and has become thoroughly familiar with all conditions which may pertain to or affect the Work under the Contract."

B. Paragraph 3.4 Labor and Materials

1. Add the following language to the end of Paragraph 3.4.1:

"Work required by the Contract Documents to be performed after working hours or work the Contractor elects to perform after hours shall be completed at no additional cost to the Owner."

2. Add Sub-subparagraph 3.4.3.1 to Sub-paragraph 3.4.3:

"The Contractor (Company) shall not be owned, operated, or managed by a registered sex offender who has been convicted of a sex offense against a minor in accordance with Iowa Code 692A.113. In addition, the Contractor shall not permit an employee, Subcontractor (Company) owned, operated, or managed by, or Subcontractor employee who is a registered sex offender convicted of a sex offense against a minor on real property of the schools of the Owner in accordance with Iowa Code 692A.113. The Contractor shall further acknowledge and certify services provided under this Contract comply with Iowa Code 692A.113."

3. Add new paragraph 3.4.4 as follows:

"Contractor shall perform the Work so as to cause a minimum of inconvenience to and interruption of the Owner's operations. Any and all interruptions of the operations of the Owner necessary for the performance of the Work shall be noted in the progress schedule and the Contractor shall additionally give the Owner sufficient advance notice of such interruption as to allow the Owner to adjust operations accordingly. Contractor's failure to give the Owner timely notice of such intentions shall place the responsibility of any resulting delays or additional costs solely with the Contractor."

C. Paragraph 3.6 Taxes

1. Add Sub-paragraphs 3.6.1, 3.6.2 and 3.6.3:

"3.6.1 This Project is Exempt from Iowa Sales Tax. The Owner will provide each contractor/subcontractor with an exemption certificate from the Iowa Department of Revenue for the purchase of building materials for this Project."

"3.6.2 At or before the time the Performance Bond is filed, Contractor shall provide a listing to the Owner identifying all subcontractors. Contractor and subcontractors may make copies of the exemption certificate and shall provide, at the time of purchase, a copy of the tax exemption certificate to each supplier providing construction material for the Project. The Contractor

or subcontractors may then purchase from the suppliers building materials for the project under this Contract free from sales tax.”

“3.6.3. The Contractor and subcontractors shall be responsible for keeping records identifying the property purchased exempt from tax and verifying that the property purchased was used in this contract with this Owner. Any property purchased tax-free and not used in this contract is subject to tax which must be paid directly to the Iowa Department of Revenue and Finance.”

D. Paragraph 3.7 Permits, Fees, Notices and Compliance with Laws

1. Sub-paragraph 3.7.4: Claims for Concealed or Unknown Conditions; add the following before the last line:

“Failure to properly register a claim within the 21 day period shall be grounds for denial of the claim.”

2. Sub-paragraph 3.7.5: Modify by adding the underlined words so that the section now reads as follows:

“3.7.5 If, in the course of the Work, the Contractor knowingly encounters and recognizes human remains, burial markers, archeological sites or previously undelineated wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence or good faith belief of such existence of such remains or features may be made as provided in Article 15.

3. Add Sub-paragraph 3.7.6:

“The Contractor is responsible for scheduling inspections related to the performance of its work and ensuring work is complete for inspections. Any costs associated with reinspection caused by irregularities, deficiencies or non-conforming work will be borne by the responsible contractor including all Architectural and Engineering Services related to evaluation of the problem and development of an acceptable solution.”

E. Paragraph 3.10 Contractor's Construction and Submittals Schedules

1. Refer to Sub-paragraph 3.10.1 in the first sentence replace "promptly after being awarded" with the following text:

"within twenty-one (21) days of the award of"

2. Refer to Sub-paragraph 3.10.1 in the last sentence after “Work and Project,” add the following text:

"or as requested by the Owner or Architect"

3. Refer to Sub-paragraph 3.10.2 in the first sentence replace “, promptly after being awarded” with the following text:

“within twenty-one (21) days of the award of ”

1.5 ARTICLE 4 – ARCHITECT

A. Paragraph 4.2.4 Communications

1. Sub-paragraph 4.2.4; Add the following subparagraphs:

“4.2.4.1 All notices, demands, requests, instructions, approvals, proposals and claims must be in writing. Any notice or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor stated on the signature page of the agreement (or at such other office as the contractor may from time to time designate in writing to the Owner), or if deposited in the United States mail in a sealed, postage-paid envelope or delivered with charges prepaid to any telegraph company for transportation, in each case addressed to such office.”

“4.2.4.2 All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the office of Solum Lang Architects, LLC., 1101 Old Marion Road NE, Cedar Rapids, Iowa 52402 and any notice to or demand upon the Owner shall be sufficiently given if so delivered, or if deposited in the United States mail in a sealed, postage prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission to said Owner at such address, or to such other representatives of the Owner may subsequently specify in writing to the Contractor for such purpose.”

“4.2.4.3 Any such notice shall be deemed to have been given as of the time of actual delivery of (in the case of mailing) when the same should have been received in due course of post, or in the case of telegrams, at the time of actual receipt, as the case may be.”

1.6 ARTICLE 7 – CHANGES IN THE WORK

A. Paragraph 7.1 Changes

1. Sub-paragraph 7.1.4: Add the following sub-paragraph:

“7.1.4 Supporting data used to determine the costs and allowances claimed in Sub-paragraph 7.3.7 must be made available to the Architect upon request.”

B. Paragraph 7.2 Change Orders

1. Sub-paragraph 7.2.2: Add the following sub-paragraph:

7.2.2 The forms used to process a Change Order will include AIA Document G701, Change Order.”

2. Sub-paragraph 7.2.3: Add the following sub-paragraph:

“7.2.3 Once reviewed and approved by the architect, all Change Orders must be submitted for approval to the Kirkwood Community College Board of Directors at their next regularly scheduled meeting. The approval application must be received at the Board Office at least one week prior to the scheduled meeting for it to be included in that meeting's scheduled business.”

C. Paragraph 7.3 Construction Change Directives

1. Sub-paragraph 7.3.3.3; Substitute the following:

- a. “.3 cost to be determined in a manner agreed upon by the parties, plus the percentage of combined overhead and profit.

2. Sub-paragraph 7.3.7; Line 4; Replace "set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount” with the following:

"indicated in sub-paragraph 7.3.11.”

3. Add sub-paragraph 7.3.11:

"7.3.11 The maximum percentage of combined overhead and profit for changes in the work performed by the Contractor shall be 10%. If the changed work is performed by a Subcontractor, a maximum of 5% may be added by that Subcontractor on his work for combined overhead and profit and an additional maximum of 5% may be added by the Contractor for administration and coordination of said Subcontractor work. This paragraph shall apply to the methods set forth in sub-paragraphs 7.3.3.1 and 7.3.3.4 for determining the costs of changed work unless waived in writing by the Owner. The Contractor shall verify compliance of the Subcontractors and shall not sign Change Orders which do not comply with the maximum limits.”

D. Paragraph 7.3 Construction Change Directives

1. Sub-paragraph 7.3.3.3; Substitute the following:

“.3 cost to be determined in a manner agreed upon by the parties, plus the percentage of combined overhead and profit.

2. Sub-paragraph 7.3.7; Line 4; Replace "set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount” with the following:

"indicated in sub-paragraph 7.3.11."

1.7 ARTICLE 8 – TIME

A. Paragraph 8.3 Delays and Extensions of Time

1. Sub-paragraph 8.3.1, line 4; Add the following language to the end of Paragraph 8.3.1:
 - a. "A time extension shall be Contractor's sole remedy and compensation for all such delays other than those resulting from the acts or negligence of the Owner, the Architect, or the Owner's separate contractors (collectively "Owner Caused Delays"). For proven Owner Caused Delays, the Contractor may recoup the actual costs resulting from such delays, but not for any additional profit or fee."

1.8 ARTICLE 9 – PAYMENTS AND COMPLETION

A. Paragraph 9.3 Applications for Payment

1. Sub-paragraph 9.3.1; change to read as follows:

"At least thirty days before....., and shall reflect retainage of three percent of the total amount due the Contractor."

B. Paragraph 9.5 Decisions to Withhold Certification

1. Delete Sub-paragraph 9.5.4 and replace with the following:

"9.5.4 The Contractor shall make accessible and available to the Architect all labor, material, and equipment accounts related to the work in question, insofar as they may in any way affect a disputed amount due the Contractor from the Owner."

C. Paragraph 9.6.Progress Payments

1. Sub-paragraph 9.6.4; Delete the first two sentences of paragraph.

D. Paragraph 9.7 Failure of Payment

1. Sub-paragraph 9.7.1; revise the sub-paragraph as follows:

In the first line, change "...seven days..." to "... fifteen days..."

In the second line, change "...seven days..." to "... fifteen days..."

E. Paragraph 9.8 Substantial Completion

1. Sub-paragraph 9.8.1; add the following to the end of the sub-paragraph:

"...subject only to completion of minor punch list items, the absence of completion of which does not interfere with the Owner's intended use of the Project."

2. Sub-paragraph 9.8.6; add the following new sub-paragraph:

"9.8.6 The Contractor shall reimburse the Owner for any Architect's additional services made necessary by the Contractor's failure to finally complete the Work within sixty (60) days after the date of Project Substantial Completion."

3. Sub-paragraph 9.8.7; add the following new sub-paragraph:

"9.8.7 Request for Early Release of Retainage Funds: If the Contractor makes a proper request for early release of retainage funds, the Owner will release all retainage funds at their next monthly Board meeting or within thirty (30) days of receipt of the request, whichever is less, except it may retain from the released retainage the following:

An amount equal to 200% of the value of labor or materials yet to be provided on the Project as determined by the Owner and its authorized contract representative. For purposes of this section, "authorized contract representative" means the Architect of record on the Project, unless otherwise specified.

An amount equal to 200% of the value of any Iowa Code Chapter 573 claims currently on file at the time the Request for Release of Retainage is approved. If the Owner withholds an amount from the retainage payment to the Contractor, the Owner will provide a reason the request is being denied to the Contractor within thirty (30) calendar days of the receipt of the request."

4. Sub-paragraph 9.8.8; add the following new sub-paragraph:

"9.8.8 Incompliance with public records laws, thirty days after final acceptance (FA +30), the Owner shall determine if there are any Iowa Code Chapter 573 claims "on file" as that phrase is used in 573.7.

If there are no claims on file at FA+30 days, the Owner shall pay the retention to the principal Contractor.

If there are claims on file at FA+30 days, the Owner shall retain twice the amount of claims.

If no action is filed within FA+60 days, the Owner shall pay the balance of retention. If an action has been filed, the Owner shall seek legal council."

F. Section 9.11 Liquidated Damages

1. Add Section 9.11 Liquidated Damages as follows:

“The Contractor and the Contractor’s surety, if any shall be liable for and shall pay the Owner the sum hereinafter stipulated as liquidated damages for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete: One Thousand Dollars (\$1,000.00) per calendar day. Such costs are in no way a penalty, but represent additional expenses to the Owner caused by the Contractor’s delay in completing the Work.”

1.9 ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

A. Paragraph 10.1 Safety Precautions and Programs

1. Add sub-paragraph 10.1.1 as follows:

"10.1.1 Contractor shall take all necessary precautions to keep the site and work in compliance with the safety and health regulations for construction issued by the Bureau of Labor Standards of the U.S. Department of Labor as well as the Occupational Safety and Health Standards parts 1910 and 1926 as amended and as enforced by the State of Iowa."

B. Paragraph 10.2 Safety of Persons and Property

1. Add the following text to Sub-paragraph 10.2.2:

"Contractors shall also comply with the Iowa Smoke Free Air Act while on Owner Property and shall not smoke any tobacco product or vape while on Owner property. For purposes of this subparagraph, Owner property shall include inside private Contractor or employee owned vehicles while parked on Owner property."

1.10 ARTICLE 11 – INSURANCE AND BONDS

A. Paragraph 11.6 Add the following sub-paragraph:

1. 11.6 Insurance Types and Limits

"11.6.1 Insurance types and limits required for this project are described in Document A133 Exhibit B-2019. A copy of this document is included in section 00 60 00 – Project Forms."

1.11 ARTICLE 13 – MISCELLANEOUS PROVISIONS

A. Paragraph 13.5: Substitute the following paragraph:

1. 13.5 Miscellaneous Provisions

"Payments due and unpaid under the Contract Documents shall bear interest from the date the payment is due and shall bear interest at the rate established by Section 74A, Code of Iowa."

1.12 ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

A. Paragraph 14.2 Termination by the Owner for cause.

1. Sub-paragraph 14.2.2; after the word "surety" insert:

"and unless otherwise prohibited by applicable statutory law."

1.13 ARTICLE 15 – CLAIMS AND DISPUTES

A. Paragraph 15.1.2 Time Limits on Claims

1. Delete 15.1.2 and replace with the following:

"15.1.2 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

15.1.2 As between the Owner and Contractor:

.1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

.2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

.3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last."

B. Subparagraph 15.2.8

1. Delete current language in its entirety and replace with the following:

"If a Claim relates to or is the subject of an Iowa Code Chapter 573 Claim, the party asserting such Claim may proceed in accordance with Iowa Code Chapter 573 to comply with the Iowa Code Chapter 573 notice and/or filing deadlines prior to resolution of the Claim by the Architect or by mediation."

C. Paragraph 15.3 Mediation:

1. Sub-paragraph 15.3.2: delete the last two sentences in this sub-paragraph.

D. Paragraph 15.4 Arbitration: Delete 15.4 in its entirety.

1.14 ARTICLE 16 – SUPPLEMENTARY CONDITIONS

A. Paragraph 16.1 Reference

1. Add the following:

"16.1 Reference

All references to provisions in Article 16 – Supplementary Conditions are hereby transferred to Section 00 73 00 – Supplementary Conditions. Any modifications stated in Section 00 73 00 shall have the same force and effect as if stated in Article 16."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 007301

SECTION 007310 – SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 TARGETED SMALL BUSINESS PROCUREMENT GOAL

- A. It is hereby agreed that when entering into this contract with the Owner, the Prime Contractors will take steps to encourage participation from Targeted Small Businesses for the purpose of subcontracting or supplying material. The project has a Targeted Small Business participation goal of ten percent (10%).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010000

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SECTION 00 80 00
SUMMARY FOR ALL CONTRACTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section and its Sub-Sections include a summary of each Bid Package.
- B. Specific requirements of each Bid Package are also indicated in individual Specification Sections and on Drawings.
- C. Related Sections include the following:
 - 1. Division 01 Section "Summary" for the Work covered by the Contract Documents, restrictions on the use of the premises, Owner-occupancy requirements, and work restrictions.
 - 2. Division 01 Section "Project Management and Coordination" for scheduling and production system meeting requirements.
 - 3. Division 01 Section "Construction Progress Documentation" for general documentation requirements.
 - 4. Division 01 Section "Temporary Facilities and Controls" for specific requirements, responsibilities and assignment of temporary facility and controls for the project.

1.02 RELATED DOCUMENTS

- A. See Sub-Sections for each Bid Package Scope of Work.

1.03 DEFINITIONS

- A. A Contractor (or General Contractor), as referenced throughout the Specifications and/or drawings, shall mean the Contractor for a Bid Package.
- B. A Subcontractor, as referenced throughout the Specifications, shall mean a Subcontractor for the Contractor of a Bid Package.
- C. A Supplier, as referenced throughout the Specifications, shall mean a Supplier for the Contractor of a Bid Package.

1.04 COORDINATION

- A. All Contractors are responsible for coordinating their work with the complete set of Specifications and Construction Drawings.
- B. Each Contractor shall be responsible for coordinating their Work with the Work of other Contractors. The Construction Manager shall facilitate coordination amongst the Contractors. All Contractors shall coordinate with the Construction Manager and with other Contractors. The completion of the Work will depend upon a collective effort by all involved.

1.05 CONSTRUCTION MANAGE

- A. Construction Manager has been engaged for this project to serve as Construction Manager at Risk and shall hold contracts with each subcontractor.

1.06 BID PACKAGE INDEX

A. The Bid Packages included in the project are as listed.

- Bid Package 1 General Construction
- Bid Package 2 Aluminum and Glazing
- Bid Package 3 Cold Metal Framing/Drywall
- Bid Package 4 Suspended Ceiling Systems
- Bid Package 5 Tiling/Carpeting/Base
- Bid Package 6 Painting
- Bid Package 7 Fire Suppression
- Bid Package 8 Mechanical (Plumbing/HVAC)
- Bid Package 9 Electrical (Electrical/Communications/Safety and Security)

1.07 BID PACKAGE DESCRIPTIONS

A. Extent of Contract: The specific description of the Work listed in each Bid Package including, but not limited to, names and terminology derived from Drawings and Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the Work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents. Include all construction layout and coordination as required to perform the Work assigned to the Bid Package.
2. Each Bid Package is a General or Prime Contractor for the specification sections and scope of work of their Bid Package Description as well as other contractual obligations indicated in Division 00 and 01. Notes in the Drawings or individual Specification Sections referencing work by "General Contractor", "Prime Contractor", or similar terminology shall be considered the responsibility of the Bid Package Contractor associated with the specification section or scope associated with the note, reference or sheet.
3. Local custom and trade-union jurisdictional settlements do not control the scope of the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall meet with the Construction Manager to resolve their differences to avoid or minimize interruption and delays.
4. Scope of work for a Bid Package Contract as stated in this Section and/or the Sub-Section for each Bid Package governs the work for a Bid Package Contractor and supersedes any and all scope of work conflicts within Individual Sections in Division 02 through Division 50, along with notes in Drawing Sheets.
5. The scope of work for each Bid Package shall include, but not necessarily be limited to, Bidding Requirements, Contract Forms, and Conditions of the Contract.

1.08 SCOPE OF WORK ITEMS COMMON TO ALL BID PACKAGES AND ALL SUBCONTRACTORS

A. Division 01 General Requirements, Complete

Clarification Notes:

1. Reference Division 01 Section 01 50 00 Temporary Facilities and Controls for specific requirements, responsibilities and assignment of temporary facility and controls for the project.
2. Contractor shall follow guidelines presented in Construction Management Safety Policy. Copies of Policy shall be made available upon request. Contractor shall have a copy of their own Company Safety Manual onsite and submit a copy to the Construction Manager.
3. If not included in the Contractor's Company Safety Manual, the Contractor shall submit their OSHA-required company Silica Control Policy/Plan along with documentation identifying who the company's on-site Component Silica Control person(s) are, prior to beginning work at the Project Site.
4. Contractor shall participate in periodic Occupational Safety and Health Consultation visits along with the Construction Manager and Iowa OSHA. The purpose of the partnership is to reduce injuries/illnesses and fatalities, provide relevant safety training and to strive for no injuries during the construction of this project.
5. Contractor shall designate competent supervision for the Project while on-site during the performance of Contractor's or any of its subcontractors' work.
6. Contractor shall protect and preserve other Contractors' work, as well as all property of Owner and other entities not identified as part of construction in the Bid Documents, as necessary in carrying out its own work.
7. Contractor shall be responsible for the loading, unloading, and handling of all materials associated with its Work along with restoration, at its expense, of temporary or permanent subgrades, surfaces, protection, enclosures, etc. disturbed by its delivery, loading, unloading, handling and/or hoisting operations.
8. Contractor shall place/move stored materials in designated areas on exterior and interior of building, as directed by and coordinate with the Construction Manager. Contractor shall move and relocate stored materials as necessary for sequencing and coordination of construction activities with other contractors.
9. Owner shall hire and pay for initial testing and inspecting services for Special Inspections noted in Construction Documents. Costs associated with re-testing and/or re-inspecting work that fails to comply with the Contract Documents will be charged to the Contractor. Contractor shall cooperate fully with the Owner's independent testing and inspection agent to satisfy the Special Inspection requirements of the locally adopted building code.
10. Contractor shall notify Construction Manager a minimum of two working days prior to the need for inspection and/or testing services.
11. Contractor shall plan to mobilize multiple times, if necessary, to complete its Work.
12. On a daily basis, Contractor shall clean up and dispose of excess waste materials and debris generated from its own Work.
13. During loading and/or unloading of equipment and materials, Contractor shall protect or repair areas and surfaces in the vicinity, at Contractor's expense.

14. Contractor shall be responsible for its own traffic control devices, methods, and/or personnel necessary to maintain safe entering and exiting of the site, when hauling materials or equipment onto or off the site and/or as necessary for completion of its work.
15. Contractor shall follow established routes in and out of the site, as directed by the Construction Manager.
16. Contractor shall be responsible for keeping all streets, parking lots, sidewalks, etc. clean from debris and mud as it pertains to its own Work, as deemed necessary by the Construction Manager or Owner's Representative.
17. Contractor shall provide construction layout, staking and surveying as required for the work of Bid Package.
18. Contractor shall excavate and backfill its own work, along with any dewatering and temporary protection to protect the public, owner or other contractors from open excavations required to complete the work of this Bid Package.
19. Contractor shall protect the public, the Owner, and other Contractors from open excavations or similar hazards with temporary orange construction fence. Protection shall be installed a minimum of 6'-0" from the leading edge of the hazard and shall be adequately supported.
20. Contractor shall provide cutting and patching for its own Work unless otherwise
21. Contractor shall be responsible for repair of damages to temporary erosion control measures that may be put in place as a result of their work.
22. Contractor shall deliver/turn over all attic stock items required by the Specifications to the Owner – as directed, and at a location designated, by the Owner.
23. Contractor shall maintain an accurate set of As-Built Drawings throughout the duration of the Project. The As-Built Drawings shall accurately show any and all deviations from the Bid Documents (e.g., deviations related to location, elevation, orientation, etc.). Contractor shall provide updates to Construction Manager's set of As-Built Drawings weekly. Contractor's set of As-Built Drawings shall be submitted to the Construction Manager upon completion of the Contractor's Work.
24. Contractor shall supply and install materials (as it pertains to its Work) for all mock-up(s) called out in Contract Documents. Contractor shall coordinate the construction of the mock-up(s) with other Bid Package Contractors.
25. All escalation costs, whatsoever as may be required and/or incurred to complete the work, shall be borne by the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 80 01
BID PACKAGE #1 - GENERAL CONSTRUCTION

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 02	EXISTING CONDITIONS
	02 41 19 Selective Demolition (As Applies to Building Demolition)
DIVISION 03	CONCRETE
	03 01 30 Maintenance fo Cast-In-Place Concrete
	03 30 00 Cast-In-Place Concrete
	03 54 13 Gypsum Cement Underlayment
DIVISION 05	Metals
	05 12 00 Structural Steel Framing
DIVISION 06	WOOD, PLASTICS, AND COMPOSITES
	06 10 53 Rough Carpentry
	06 41 16 Plastic-Laminated-Faced Architectural Cabinets
	06 64 00 Plastic Paneling
DIVISION 07	THERMAL AND MOISTURE PROTECTION
	07 42 65 Continously Insulated Wall Assembly
	07 54 23 Thermoplastic Polyolefin (TPO) Roofing
	07 62 00 Sheet Metal Flashing and Trim
	07 71 00 Roof Specialties
	07 72 00 Roof Accessories
	07 92 00 Joint Sealants
DIVISION 08	OPENINGS
	08 11 13 Hollow Metal Doors and Frames
	08 14 16 Flush Wood Doors
	08 71 00 Door Hardware
DIVISION 10	SPECIALTIES
	10 22 23 Hanging Panels
	10 22 26 Operable Partitions
	10 26 00 Wall and Door Protection
	10 28 00 Toilet, Bath, and Laundry Accessories
	10 44 13 Fire Protection Cabinets
	10 44 16 Fire Extinguishers

DIVISION 12**FURNISHINGS**

12 36 23.13 Plastic-Laminate-Clad Countertops

12 36 61.16 Solid Surfacing Countertops

12 36 61.19 Quartz Acclomerate Countertops

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. This package includes interior and building demolition for all floor coverings, ceilings, floor slabs, wall coverings, walls, ceilings, and misc. removals required by contract documents.
3. Provide labor, materials, and equipment for temporary bracing and shoring, as required for demolition.
4. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.
5. Hollow metal frames in Metal Stud Construction will be installed by Bid Package #3 Contractor. This contractor will unload and coordinate the storage and distribution of hollow metal frames. Provide installation of doors and hardware.
6. Aluminum hardware to be installed Bid Package #2.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests may be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.

13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #2 - ALUMINUM AND GLAZING

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 07	THERMAL AND MOISTURE PROTECTION
	07 92 00 Joint Sealants (As Applies)
DIVISION 08	OPENINGS
	08 41 13 Aluminum-Framed Entrances and Storefronts
	08 80 00 Glazing
DIVISION 10	Specialties
	10 26 00 Glazed Interior Wall & Door Assemblies

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. This bid package shall include supply and installation of automatic door operators.
3. This bid package shall install aluminum door hardware provided by BP #1.
4. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
Reference overall schedule provided in bid documents for the start, duration and completion dates for
5. the work within this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.

9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction Manager.
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.
13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #3 - COLD METAL FRAMING/DRYWALL

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 05	METALS
05 40 00	Cold Formed Metal Framing
DIVISION 06	WOOD, PLASTICS AND COMPOSITES
06 1600	Sheathing
DIVISION 07	THERMAL AND MOISTURE PROTECTION
07 21 00	Thermal Insulation
07 92 00	Acoustical Joint Sealants
DIVISION 09	FINISHES
09 22 16	Non-Structural Metal Framing
09 29 00	Gypsum Board

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
3. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.
4. This bid package shall include material and installation of all backing for items listed in Bid Package #1.
5. This bid package includes insulation as detailed and specified in your walls.
6. Box headers to be provided at all double door frames.
7. Sound caulking at top and bottom of walls to be by this bid package.
8. This bid package includes setting hollow metal frames. Frames installed by this package that are installed incorrectly or do not allow for doors to function properly, will be fixed by this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.

5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.
13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.

Cleaning up debris from your construction operation is part of this work package. If the contractor
14. fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #4 - SUSPENDED CEILING SYSTEMS

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 09	FINISHES
	09 51 13 Acoustical Panel Ceilings

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
3. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.

13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #5 - TILE, CARPET AND BASE

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 09	FINISHES
09 30 13	Ceremic Tiling
09 65 13	Reslient Base and Accessories
09 65 19	Resilient Tile Flooring
09 68 13	Tile Carpeting

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. Floor Prep is to be included in this bid package.
3. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
4. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.

13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #6 - PAINTING

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 09	FINISHES
09 91 23	Interior Painting
09 93 00	Staining and Transparent Finishing

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
3. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.

13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #7 - FIRE SUPPRESSION

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 7	THERMAL AND MOISTURE PROTECTION
07 92 00	Joint Sealants (As Applies)

DIVISION 21	FIRE SUPPRESSION - COMPLETE
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SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. All utility shutdowns require a 72-hour notice to Owner and CM and a pre-installation meeting.
3. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
4. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility. Mechanical or Electrical permits are by others.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.
8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.

13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #8 - MECHANICAL

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 7	THERMAL AND MOISTURE PROTECTION 07 92 00 Joint Sealants (As Applies)
DIVISION 22	PLUMBING - COMPLETE
DIVISION 23	HEATING, VENTILATION AND AIR CONDIDTIONING (HVAC) - COMPLETE

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. All utility shutdowns require a 72-hour notice to Owner and CM and a pre-installation meeting.
3. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
4. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.
5. This package shall provide any demolition, cutting and patching required by contract documents to complete your work.
6. Provide any mechanical permits, inspections and fees required for this contractor's work.
7. Include firestopping and sealants for own work.
8. This package shall be responsible for own equipment pads (concrete) or supports as required.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.

8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.
13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 00 80 01
BID PACKAGE #9 - ELECTRICAL

The Scope of Work shall include the project manual, drawings, specifications and as per below. Related specifications are limited to the contractors required needs to perform the work.

Provide and install the following Scope of Work unless otherwise noted:

DIVISION 7	THERMAL AND MOISTURE PROTECTION 07 92 00 Joint Sealants (As Applies)
DIVISION 26	ELECTRICAL - COMPLETE
DIVISION 27	COMMUNICATIONS - COMPLETE
DIVISION 28	ELECTRONIC SAFETY AND SECURITY - COMPLETE

SCOPE OF WORK

1. Provide and install work documented, detailed, and specified in Construction Documents.
2. All utility shutdowns require a 72-hour notice to Owner and CM and a pre-installation meeting.
3. Maintain facilities as required to keep building operational. Coordinate with Construction Manager and Owner.
4. Reference overall schedule provided in bid documents for the start, duration and completion dates for the work within this bid package.
5. Electrical permits, inspections and fees are to be included in this contract.
6. This package shall provide any demolition, cutting and patching required by contract documents.
7. Provide temporary lighting as required.
8. Provide firestopping and joint sealants for own work.

SCOPE REQUIREMENTS FOR ALL BID PACKAGES

1. Contractor shall provide construction layout, staking and surveying as required for their work.
2. All bid package are required to do their due diligence in recognizing asbestos, stopping construction if any asbestos is discovered and notifying the school district of asbestos.
3. Work shall proceed as required by the Construction Manager, after the Notice to Proceed is received by the contractor.
4. Owner shall provide General Building Permit only. Any additional permits that are required for the completion of this work package or as required by any governing body is this contractor's responsibility.
5. Shop drawings and submittals are required ten working days after Notice to Proceed is received. One electronic copy is required for submittals.
6. Insurance certificates are to be submitted prior to the start of work and resubmitted upon renewal or policy change.
7. All payment requests shall be completed on AIA G702 and AIA G703 by the 20th of each month. All other forms of payment requests will be rejected and returned to the applicant for corrections.

8. All costs associated with escalation, whether required or incurred to complete the work, shall be the responsibility of this contractor. This is a hard cost bid.
9. Provide legal and proper disposal of all materials except for asbestos.
10. Provide all barricades, warning signs, and lights as deemed necessary by Owner/Construction
11. It is this contractor's responsibility to meet or exceed OSHA safety standards.
12. Provide coordination and cost of all inspections with the appropriate agencies. It is the contractor's responsibility to abide by all governing building codes, regulations, and safety codes.
13. The Construction Manager will not be responsible for receiving or unloading any material that is provided by this contractor. All material delivery is to be coordinated with the onsite Construction Manager. This is to allow for proper scheduling and storage of all material. Indicate in your submittals any storage requirements beyond those that are found in the specifications. Any material that is delivered without the authorization of the Construction Manager will be rejected and a new delivery date will be scheduled. No additional shipping or storage charges for the reshipping of any material may be billed to or against the Architect, Owner, or Construction Manager. It is the responsibility of the supplier to coordinate this with the Construction Manager. A 24-hour notification of delivery to the Construction Manager is required.
14. Cleaning up debris from your construction operation is part of this work package. If the contractor fails to keep their site clean, the Construction Manager will inform the contractor of the situation in writing and give them 24-hour notice to correct the situation. If the contractor fails to correct the situation, the Construction Manager will hire another party for cleaning and back charge the said contractor. The cleaning charges will be \$95/hour/man plus equipment rental, cleaning supplies, and removal charges.
15. This contractor shall prevent migration of mud, dirt, and debris onto permanent road-ways/parking lots and/or clean up to satisfaction of authorities and/or owner. This is preventable. If tracking cannot be controlled, Construction Manager and or the Owner have the right to stop activities causing the issue until this contractor can regain control and remedy tracking. Any stoppage of work due to this scenario will not be an instance for any back charging cost or time delays to the Construction Manager or the Owner.
16. The contractor shall protect the work of other contractors and existing conditions. Repair or replacement of these items is the responsibility of the contractor. All Contractors shall be cognizant of the work of others. Any damage inflicted upon previously installed work by a contractor shall be the responsibility of the damaging contractor. The owner shall supply a dumpster for construction refuse only. No concrete debris or rubble allowed.
17. Pre-Construction Meeting will be held prior to commencement of any work.
18. Weekly meetings will be held by the Construction Manager and attendance is **mandatory** when requested.
19. Reference 00 80 00 Summary for All Contracts

END OF SECTION

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: East Hall Renovation – Kirkwood Community College.

1. Project Location: 1025 Kirkwood Pkwy SW – Cedar Rapids, IA

B. Owner: Kirkwood Community College.

1. Owner's Representative: Monica Davis.

C. Architect: Solum Lang Architects, LLC.

D. Construction Manager: Larson Construction Co. has been engaged as Construction Manager for this Project.

E. Project Web Site: A project Web site administered by Construction Manager will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination." for requirements for establishing, administering, and using Project Web site.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. This is a remodel of 50,000 SF on Levels 1 and 2 of East Hall located on the Kirkwood Community College campus. The existing building is a 2-stories used for general business occupancy. The project scope includes exterior signage and the interior remodel of existing office and shell space into new offices, conference rooms and training spaces. Updates will be made to mechanical and electrical systems including the installation of new rooftop equipment. Existing sprinkler and life safety systems will remain in place. The new interior construction will be drywall with steel studs, built in casework, floor, wall and ceiling finishes.

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Preceding Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
 - 1. Mold Mitigation
- C. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. Mold Testing

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

- b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than seven days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than seven days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01: Exterior Signage Structure.

1. Base Bid: NO WORK.
2. Alternate: NEW GROUND MOUNTED - SELF SUPPORTED SIGN ELEMENT W/ NEW CONCRETE FOUNDATION SYSTEM, CUSTOM PERFORATED PANELS, ALUMINUM LETTERS ON STANDOFFS, & LED LIGHTING.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. 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.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. 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 schedule of values consistent with format of AIA Document G703.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

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.
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. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. 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.
9. 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.

1.3 APPLICATIONS FOR PAYMENT

- A. 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. Application for Payment Forms: Use AIA Document G702-2019 and AIA Document G703 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 three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. 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 lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit executed waivers of lien on forms 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. Sustainable design submittal for project materials cost data.
 - 4. Contractor's construction schedule (preliminary if not final).
 - 5. Sustainable design action plans.
 - 6. Schedule of unit prices.
 - 7. Submittal schedule (preliminary if not final).
 - 8. List of Contractor's staff assignments.
 - 9. List of Contractor's principal consultants.
 - 10. Copies of building permits.
 - 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 12. Initial progress report.
 - 13. Report of preconstruction conference.
 - 14. Certificates of insurance and insurance policies.
- H. Application for Payment at Substantial Completion: After Architect issues 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: After completing Project closeout requirements, 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 G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "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 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project Web site.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

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

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include 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.
 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs 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 information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site and submit not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT WEB SITE

- A. Provide, administer, and use Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
 1. Project directory.
 2. Project correspondence.
 3. Meeting minutes.
 4. Contract modifications forms and logs.
 5. RFI forms and logs.
 6. Task and issue management.
 7. Photo documentation.
 8. Schedule and calendar management.
 9. Submittals forms and logs.
 10. Payment application forms.
 11. Drawing and specification document hosting, viewing, and updating.
 12. Online document collaboration.
 13. Reminder and tracking functions.
 14. Archiving functions.
- B. Provide up to Project Web site user licenses for use of Owner, Architect, and Architect's consultants.
- C. On completion of Project, provide one complete archive copy(ies) of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.
- D. Provide one of the following Project Web site software packages under their current published licensing agreements:
 1. Submittal Exchange.

1.8 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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Sustainable design requirements.
 - l. Preparation of record documents.
 - m. Use of the premises and existing building.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

- a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility problems.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at weekly intervals.
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 meeting 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.

1) Review schedule for next period.

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events.
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.
 - 14. Change Orders received and implemented.
 - 15. Construction Change Directives received and implemented.
 - 16. Services connected and disconnected.
 - 17. Equipment or system tests and startups.
 - 18. Partial completions and occupancies.
 - 19. Substantial Completions authorized.

- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules 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 performance of construction activities.

END OF SECTION 013200

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

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

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

- a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.

- i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:

1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.

- c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 - 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017000 "Execution and Closeout Requirements."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. 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.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems 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.

- C. Fabricator Qualifications: A firm experienced in producing products 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.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

- d. When testing is complete, remove test specimens, assemblies; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

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

1.04 TEMPORARY FACILITIES RESPONSIBILITY

- A. Existing electrical power may be used. Usage will be by Owner, temporary boards/trailer hook-ups shall be by electrical contractor.
- B. Electrical contractor shall provide adequate temporary lighting in all construction areas.
- C. Water Usage will be by owner, hook-up and coordination by mechanical contractor.
- D. Temporary heat, gas usage shall be by Owner. Shelter and proper enclosure to eliminate wasteful heating shall be by contractor requiring same.
- E. Temporary Toilet Facilities: By Construction Manager.
- F. Temporary Power for Site Improvements: By Contractor requiring same.
- G. Temporary Telephone, Data and Fax Service: By Contractor requiring same.
- H. Field Office Trailer: By Construction Manager.
- I. Temporary Electricity to Construction Manager's Office Trailer: By Electrical Contractor.
- J. Contractor Field Office: By Contractor requiring same.
- K. Temporary Electricity to other Trailers: By Contractor requiring same.
- L. Temporary Site Access Roads: N/A
- M. Temporary Site Access Road Maintenance: N/A
- N. Snow Removal for Jobsite Access: By Construction Manager.
- O. Concrete Washout: By Contractor requiring same.
- P. Traffic Control: By Contractor requiring same.
- Q. Contractor Parking: As directed by Construction Manager and Owner.
- R. Dewatering Facilities and Drains for the Work: By Contractor requiring same.
- S. Project Identification and Temporary Signs: By Construction Manager.
- T. Scaffolding and Ladders: By Contractor requiring same.
- U. Temporary Shoring: By Contractor requiring same.
- V. Lifts and Hoists: By Contractor requiring same.
- W. Hoisting and Offloading: By Contractor requiring same.

- X. Temporary Material Storage: By Contractor requiring same.
- Y. Temporary Fence/Gates: Construction Manager will provide temporary fencing and temporary gates as shown on Staging Plan. Additional measures required for material, tool and equipment security shall be by Contractor requiring same.
- Z. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection of Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- AA. Roof and Floor Opening Protection: By Contractor requiring same.
- BB. Temporary Partitions/Area Separation Walls: By Construction Manager.
- CC. Dust Protection Measures: By Contractor requiring same.
- DD. Dumpster Facilities for typical new construction waste: By Construction Manager.
- EE. Daily Progress Cleaning: By all Contractors.
- FF. Environmental Protection: By Contractor requiring same.
- GG. Temporary Erosion and Sedimentation Control: N/A
- HH. Storm Water Pollution Prevention Plan Recording, Maintenance and Inspections: N/A
 - II. Tree and Plant Protection: By Contractor requiring same.
 - JJ. First Aid Supplies: By Contractor requiring same.
 - KK. Pest Control: By Construction Manager.
 - LL. Barricades, Warning Signs, and Lights: By Contractor requiring same.
- MM. Fall Protection: By Contractor requiring same.
- NN. Leading Edge Protection: By Contractor requiring same.
- OO. Temporary Fire Protection: By Contractor requiring same.
- PP. Hot Work Permit: By Contractor requiring same.
- QQ. Protection of Existing or Contractor Installed Work: By Contractor requiring same.

1.05 USE CHARGES

- A. Water Service: The Owner shall pay for the cost of the water consumed and ran through the meter. Provide connections to services provided as required for construction operations.
- B. Electric Power Service: The Owner shall pay electric power service use charges for electricity used by all entities for construction operations. Provide connections and extensions of services as required for construction operations.

1.06 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.07 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on the site.
- B. 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

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 Related Requirements:

- 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS

2.1 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.

2.2 MAINTENANCE MATERIALS

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

2.3 PRODUCT WARRANTIES

- A. 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.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are include with the Specifications, prepare a written document using indicated from properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

PART 3 - EXECUTION

3.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Where products are accompanied by the term "as selected," Architect will make selection.
 4. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless approved by the Architect prior to bid.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Basis-of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product, that meets or exceeds the characteristics of the basis-of-design product, by one of the other named manufacturers. Drawings and specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Designation as an acceptable comparable manufacturer does not signify acceptance of a specific product by that manufacturer unless it is deemed, by the Architect, as meeting or exceeding the characteristics of the basis-of-design product.
 - a. Construction Document design is based on the basis-of-design product listed, if a comparable product from another named manufacturer is proposed, the Architect shall consider the Contractor's selection of a comparable product when the following conditions are satisfied. If all of the following conditions are not satisfied, Architect will return requests without action, except to record non-compliance with these requirements:

- 1) Selected comparable product must be from one of the manufacturer's listed as an acceptable manufacturer in the specifications.
 - 2) Evidence that the selected comparable product does not require extensive revisions to the Contract Documents and will produce the indicated results, and that it is compatible with other portions of work.
 - 3) Detailed comparison of significant qualities of proposed comparable product with the basis-of-design product named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 4) Evidence that comparable product provides warranty which meets or exceeds that specified.
 - 5) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 6) Samples, if requested.
- b. Products by unnamed manufacturers will only be considered prior to bid. Comply with "Comparable Product Requests" paragraphs for consideration of comparable products.
 - c. Where a list of manufacturers is not provided, comply with "Comparable Product Requests" paragraphs for consideration of comparable products. Comparable product request will only be considered prior to bid.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample" provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

3.2 SUBSTITUTION LIMITATIONS

- A. See Section 01 25 00 - Substitution Procedures.
- B. Submit substitution request on Substitution Request Form provided in the Specification Manual.
 1. Notification of approved substitutions shall be provided by Addendum.
 2. Use product specified if Architect does not issue a decision on use of a substitution request within time allocated.

3.3 COMPARABLE PRODUCT REQUESTS

- A. Submit request for consideration of each comparable product during the bidding period complying with same time restriction as substitutions, using same form as substitution

requests. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within three days of receipt of request.
2. Notification of approved substitutions shall be provided by Addendum.
3. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

3.4 TRANSPORTATION AND HANDLING

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

3.5 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.

- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 017000 – EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Examination, preparation, and general installation procedures.
 - 2. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
 - 3. Cutting and patching.
 - 4. Laying out the Work.
 - 5. Cleaning and protection.
 - 6. Starting of systems and equipment.
 - 7. Demonstration and instruction of Owner personnel.
 - 8. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
 - 9. General requirements for maintenance service.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 SUBMITTALS

- A. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.

- c. Products: List products to be used for patching and firms or entities that will perform patching work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
- 1) Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.4 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. 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 that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or 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. Other construction elements include but are not limited to the following:

- a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
1. Limit conduct of noisy interior work from 6-8 AM or after 4 PM. Spaces are occupied during construction activities.
- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate sections.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- G. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- H. 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 Information: Furnish information to [local utility] [Owner] that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Clean substrate surfaces prior to applying next material or substance.
- E. Seal cracks or openings of substrate prior to applying next material or substance.
- F. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

3.4 GENERAL INSTALLATION REQUIREMENTS

- 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.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- D. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor

bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- E. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- F. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- G. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- H. Make neat transitions between different surfaces, maintaining texture and appearance.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- D. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- G. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- H. Clean existing systems and equipment.
- I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- 3.6 CUTTING AND PATCHING
- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
 2. Fit products together to integrate with other work.

3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- G. Temporary Support: Provide temporary support of work to be cut.
- H. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- I. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- J. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions 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.
 6. Proceed with patching after construction operations requiring cutting are complete.
- K. Restore work with new products in accordance with requirements of Contract Documents.

- L. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- M. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.
- N. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 2. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
 - 4. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 5. Match color, texture, and appearance.
 - 6. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.7 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
 - 1. Mow grass and weed growth areas to keep growth maintained.
- 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to 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

3.9 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. 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 designated 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; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment[, elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.

- C. Use cleaning materials that are nonhazardous.
- D. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- E. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- F. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- G. Clean filters of operating equipment.
- H. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- I. Clean site; sweep paved areas, rake clean landscaped surfaces.
- J. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- B. Substantial Completion Procedures
 - 1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
 - 2. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - a. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - b. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - c. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - d. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and

similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

- 1) Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section.
 - e. Submit test/adjust/balance records.
 - f. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
 - g. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
3. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
- a. Advise Owner of pending insurance changeover requirements.
 - b. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - c. Complete startup and testing of systems and equipment.
 - d. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
 - f. Advise Owner of changeover in heat and other utilities.
 - g. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - h. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - i. Complete final cleaning requirements, including touchup painting.
 - j. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
4. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. 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's punch list, that must be completed or corrected before certificate will be issued.
- a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - b. Results of completed inspection will form the basis of requirements for final completion.

- C. Conduct Substantial Completion inspection and create Final Correction Punch List containing
 - a. Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- D. Final Completion Procedures:
 - 1. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 - a. Submit a final Application for Payment according to Division 01 Section "Price and Payment Procedures."
 - b. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - c. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - d. Submit pest-control final inspection report and warranty.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 - 2. Inspection: Submit a written request for final inspection to determine 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.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- E. List of Incomplete Items (Punch List)
 - 1. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - a. Organize list of spaces in sequential order.
 - b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3.14 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.15 PROJECT COMPLETION

- A. After Substantial and Final Completion have been achieved and Punch List items repair of work have been completed, the Architect shall notify the Owner in writing that the Project is complete. Contractors to provide signed off and completed punchlists.
- B. In compliance with public record requirements, the Owner shall report that the project is complete and issue a final acceptance.
- C. The Owner directly, or acting through the Architect will notify the principal Contractor in writing that the project has reached completion and final acceptance as of the date determined in the public record. Upon receipt of this notification, the principal Contractor shall notify all subcontractors and material providers of the date of completion and final acceptance.
- D. If any exist, the Owner will directly notify all claimants for labor and material who have filed a claim with the Owner of the date of completion and final acceptance.
- E. In compliance with public records laws, thirty days after final acceptance (FA+30), the Owner shall determine if there are any Iowa Code Chapter 573 claims "on file" as that phrase is used in 573.7.
 - 1. If there are no claims on file at FA+30 days, the Owner shall pay the retention to the principal Contractor.
 - 2. If there are claims on file at FA+30 days, the Owner shall retain twice the amount of claims.

- F. If no action is filed within FA+60 days, the Owner shall pay the balance of retention. If an action has been filed, the Owner shall seek legal counsel.

3.16 MAINTENANCE

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

END OF SECTION 017000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.

4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
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.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

- A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.
- B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- C. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- E. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- F. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- G. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- H. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- I. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- J. Conduit: Reduce conduit to straight lengths and store by type and size.

3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.6 SAMPLE FORMS

END OF SECTION 017419

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite

bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.

8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.

5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017000 "Execution and Closeout Requirements" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections:
 - 1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 2. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal: Submit PDF electronic files of marked-up record prints. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal: Submit PDF electronic files of marked-up record prints, including all sheets, whether or not changes and additional information were recorded.
 - c. Final Submittal: Submit PDF electronic files of marked-up record prints and one set of record digital data files. Include each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Annotated PDF electronic file with comment function enabled.
 - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 3. Refer instances of uncertainty to Architect for resolution.
 - 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect.
- e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301 (ACI 301M).
 - 2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type , [gray].
 2. Fly Ash: ASTM C 618, Class F or C.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Color: As selected by Architect from manufacturer's full range.
- F. Water: ASTM C 94/C 94M and potable.

2.5 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513,[with factory-installed metal eyelets,] for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Williams Products, Inc.
- B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JP Specialties, Inc.

- b. Sika Corporation.
- C. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BoMetals, Inc.
 - b. Paul Murphy Plastics Company.
 - c. Sika Greenstreak.
 - d. Vinylex Waterstop & Accessories.
- D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Barrier-Bac; Inteplast Group, Ltd.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. CETCO, a Minerals Technologies company.
 - d. Concrete Sealants Inc.
 - e. Henry Company, Sealants Division.
 - f. JP Specialties, Inc.
 - g. Sika Greenstreak.
- E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adeka Ultra Seal/OCM, Inc.
 - b. CETCO, a Minerals Technologies company.
 - c. Grace Construction Products; W.R. Grace & Co. -- Conn.
 - d. Sika Greenstreak.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Normal-Weight Concrete:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) and 3000 psi (20.7 MPa), see plans, at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. 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. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed [1/4 inch (6 mm)] [3/16 inch (4.8 mm)] [1/8 inch (3.2 mm)].
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply 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.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.12 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

SECTION 035413 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes self-leveling, gypsum cement underlayment for application below interior floor coverings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

PART 2 - PRODUCTS

2.1 GYPSUM CEMENT UNDERLAYMENTS

- A. Gypsum Cement Underlayment: Self-leveling, gypsum cement product that can be applied in minimum uniform thickness of 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas.
 - b. MAPEI Corporation.
 - c. Maxxon Corporation.
 - d. United States Gypsum Company.
 - 2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 2500 psi (17.2 MPa) at 28 days when tested according to ASTM C 109/C 109M.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- F. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m) in 24 hours.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.2 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.

2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
1. Apply a final layer without aggregate to product surface.
 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

END OF SECTION 035413

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SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, testing agency].
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. Source quality-control reports.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Finish: Plain.
- D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Finish: Plain.

E. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Plain.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.4 PRIMER

A. Primer: Comply with Section 099000 "Painting and Coating."

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.

3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Slip critical as noted on plans.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 - 2. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 051200

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Load-bearing wall framing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product test reports.
- D. Research reports.

1.4 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST50H (ST340H).
 2. Coating: G60 (Z180) or equivalent.

2.3 INTERIOR WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
 1. Minimum Base-Metal Thickness: 20 Gauge or 0.0329 inch (0.84 mm).
 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

- 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

- A. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- B. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- C. Install framing members in one-piece lengths.
- D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- E. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- F. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- H. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically as indicated. Fasten at each stud intersection.
1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel trim including steel angle corner guards.

1.2 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

2.2 FABRICATION, GENERAL

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

2.3 MISCELLANEOUS STEEL TRIM

- A. Steel angle corner guards.
 1. Style: 16 Gauge Type 304 Stainless Steel.
 2. Dimensions: 1-1/2" Flanges
 3. Height: 7'-0"
 4. Finish: Brushed
 5. Mounting: Adhesive
 6. Application: All outside corners.

2.4 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.

END OF SECTION 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Plywood backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated wood.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional

20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.[Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.]
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Concealed blocking.
 2. Plywood backing panels.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Cants.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
- C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Northern species, No. 3 Common grade; NLGA.
 2. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- B. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

END OF SECTION 061053

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SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 123623.13 "Plastic-Laminate-Clad Countertops."
2. Section 123661.16 "Solid Surfacing."
3. Section 123661.19 "Quartz Agglomerate Countertops."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Plastic laminates, for each color, pattern, and surface finish.
2. Thermoset decorative panels, for each color, pattern, and surface finish.

1.3 INFORMATIONAL SUBMITTALS

A. Woodwork Quality Standard Compliance Certificates: Adhere to AWI Quality Certification Program standards.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Adhere to AWI Quality Certification Program standards.

B. Installer Qualifications: Adhere to AWI Quality Certification Program standards.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- H. Colors, Patterns, and Finishes: Refer to Drawings.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.

- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- B. Back-Mounted Pulls: BHMA A156.9, B02011.
- C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- A. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- B. Shelf Rests: BHMA A156.9, B04013; metal.
- C. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 - 3. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 - 4. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 - 5. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-100.
- D. Door and Drawer Silencers: BHMA A156.16, L03011.
- E. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Contact cement.

2.5 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to

provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

END OF SECTION 064116

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyisocyanurate foam-plastic board.
 - 2. Glass-fiber blanket.
 - 3. Mineral-wool blanket.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. Dow Chemical Company (The).
 - d. Firestone Building Products.
 - e. Hunter Panels.
 - f. Rmax, Inc.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing

ASTM E 136 for combustion characteristics. Sound Transmission Class: ASTM C423 based on manufacturer's published data on thickness and wall assembly.

1. Utilized "Sound Batt Insulation" for all interior wall conditions.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Knauf Insulation.
 - e. Owens Corning.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple

layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

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SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fiber-cement siding for interior installation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For fiber-cement siding including related accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Research/evaluation reports.
- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide "Nichiha Illumination series or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. GAF Materials Corporation.
 - c. James Hardie Building Products, Inc.
- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Size: 18" High x 6'-0" Long x 5/8" Thick.

2.3 ACCESSORIES

- A. Fasteners:
 - 1. As recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Install fasteners per manufacturer's recommendations.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.2 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For the following products:
 1. Sheet roofing, of color required.
 2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 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 (MATCH EXISTING MEMBRANE TYPE AND MANUFACTURER) – GC TO CONFIRM:
 - 1. Carlisle SynTec Incorporated.
 - 2. Firestone Building Products.
 - 3. GAF Materials Corporation.
 - 4. Johns Manville; a Berkshire Hathaway company.
- B. Source Limitations: Obtain ALL system components including but not limited to adhesives, roof insulation, fasteners, etc. for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- C. Roofing System Design: Tested by a qualified testing agency to resist code required uplift pressures.
- D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

- F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

- A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible fabric-backed TPO sheet.
 - 1. Thickness: 60 mils (1.5 mm), nominal.
 - 2. Exposed Face Color: White (Match Existing).

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- F. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

- A. MATCH Existing if present.

2.6 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Firestone Building Products.
 - c. GAF Materials Corporation.
 - d. Johns Manville; a Berkshire Hathaway company.
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.
 1. Full-spread spray applied, low rise, two-component urethane adhesive (compatible with existing roof assembly).
- C. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Building Products; Dens Deck (Match Existing assembly)

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.

- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.2 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.3 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Install tapered insulation under area of roofing to conform to slopes indicated.
- C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
 - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- D. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m), and allow primer to dry.
 - 2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 - 3. Set each layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.
- E. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

2. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
 3. Set each subsequent layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.
- F. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.
1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- G. Install slip sheet over cover board and immediately beneath roofing. (Verify)

3.4 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- D. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.
- E. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured through-wall flashing and counterflashing.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.
4. Formed equipment support flashing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Product test reports.

- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings & roof edge flashings tested according to SPRI ES-1 and capable of resisting code required design pressures.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required. (VERIFY EXISTING AND MATCH CONDITIONS).
1. As-Milled Finish: Standard one-side bright.
 2. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
 3. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
 4. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 5. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 6. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 7. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS (MATCH EXISTING SYSTEM)

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Engineered Coated Products.
 - c. Kirsch Building Products, LLC.
 - d. SDP Advanced Polymer Products Inc.

- C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. Carlisle Residential; a division of Carlisle Construction Materials.
 - c. Drexel Metals.
 - d. Grace Construction Products; W.R. Grace & Co. -- Conn.
 - e. Henry Company.
 - f. Kirsch Building Products, LLC.
 - g. Owens Corning.
 - h. Polyguard Products, Inc.
 - i. Protecto Wrap Company.
 - j. SDP Advanced Polymer Products Inc.
 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight.
 - 1. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.

- B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
- C. Counterflashing and Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch (0.81 mm) thick.
- D. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch (0.71 mm) thick.
- E. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

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, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. 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.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of [uncoated-aluminum] [and] [stainless-steel] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of [10 feet (3 m)] <Insert dimension> with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.
- C. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch (25 mm) below scupper discharge.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [elastomeric] [butyl] sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mildew-resistant joint sealants.
 - 2. Latex joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports.
- D. Field-adhesion-test reports.
- E. Sample warranties.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accumetric LLC.
 - b. Franklin International.
 - c. GE Construction Sealants; Momentive Performance Materials Inc.
 - d. Grabber Construction Products.
 - e. Hilti, Inc.

- f. OSI Sealants; Henkel Corporation.
 - g. Pecora Corporation.
 - h. Serious Energy Inc.
 - i. Tremco Incorporated.
 - j. United States Gypsum Company.
- 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.
- B. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- C. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.3 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. Soudal USA.
 - e. Tremco Incorporated.
- C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Franklin International.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. Pecora Corporation.
 - e. Sherwin-Williams Company (The).
 - f. Tremco Incorporated.

2.4 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alcot Plastics Ltd.
 - b. BASF Corporation; Construction Systems.
 - c. Construction Foam Products; a division of Nomaco, Inc.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 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.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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 laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind 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.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, & casework.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Steelcraft.

2.2 INTERIOR FRAMES

- A. Standard-Duty Frames: SDI A250.8, Level 1. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level C according to SDI A250.4.

2. Frames:
 - a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.
- G. Glazing: Section 088000 "Glazing."

2.5 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 metal thickness. 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. 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. Sidelite 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.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 - 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
 - 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.
- C. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- D. Stops and Moldings: Provide stops and moldings around glazed lites and louvers 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 glazing and installation types indicated.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: SDI A250.10.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
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-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 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 plumb, square, 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 will be 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 power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. 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.
- 5. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
- 6. 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Glazing: Comply with installation requirements in Section 088000 "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 (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.2 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.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.

C. Samples: For factory-finished doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Forte.
2. VT Industries Inc.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.

C. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Cherry.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Core: Either glued wood stave or structural composite lumber.
8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
9. Construction: Seven plies, either bonded or nonbonded construction.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood-Veneered Beads for Light Openings in Wood Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

1. Profile: Flush rectangular beads.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish.
 - 3. Staining: Match existing.
 - 4. Effect: Filled finish.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor

finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior storefront framing.
2. Interior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.
1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each exposed finish required.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.
- E. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Field quality-control reports.
- D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing

those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to [1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 11 feet 8-1/4 inches (3.6 m) or 1/175 times span, for spans less than 11 feet 8-1/4 inches (3.6 m).
- D. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 2. Entrance Doors:

- a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).
- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
 - 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 35 as determined according to NFRC 500.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MATCH EXISTING SYSTEM - VERIFY
 - a. Kawneer North America; an Alcoa company.
 - b. Oldcastle BuildingEnvelope™.
 - c. Tubelite Inc.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken (Verify and Match Existing).
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front (Verify and Match Existing).
 - 4. Finish: Clear anodic finish (Verify and Match Existing).
 - 5. Fabrication Method: Field-fabricated stick system.

- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width (Verify and Match Existing).
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets (Verify and Match Existing).
 - a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware.
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion[and not more than 15 lbf (67 N) to open the door to its minimum required width].
 - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame (MATCH EXISTING).
- E. 90 Degree Offset Pulls (MATCH EXISTING).
- F. Push Bars (MATCH EXISTING).
- G. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force (MATCH EXISTING).
- H. Surface Auto Operators (MATCH EXISTING).
- I. Jamb Mounted Actuators (MATCH EXISTING).
- J. Wall Mount Actuators (MATCH EXISTING).
- K. Weather Stripping: Manufacturer's standard replaceable components.

- L. Silencers: BHMA A156.16, Grade 1.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker (Verify and Match Existing).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

- D. Prepare test and inspection reports.

3.3 ENTRANCE DOOR HARDWARE SETS

END OF SECTION 084113

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SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for interior doors and borrowed lites.

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AGC Glass Company North America, Inc.
 2. Cardinal Glass Industries.
 3. Cristacurva.
 4. Dlubak Corporation.
 5. Gardner Glass, Inc.
 6. GGI; General Glass International.
 7. Glasswerks LA, Inc.
 8. GTI; Glaz-Tech Industries.
 9. Guardian Industries Corp.; SunGuard.
 10. Hartung Glass Industries.
 11. JE Berkowitz, LP.
 12. Northwestern Industries, Inc.
 13. Oldcastle BuildingEnvelope™.
 14. Pilkington North America.
 15. PPG Industries, Inc.
 16. Schott North America, Inc.
 17. Tecnoglass.
 18. Trulite Glass & Aluminum Solutions, LLC.

- 19. Vetrotech Saint-Gobain.
- 20. Viracon, Inc.

2.2 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- B. Thickness: Where glass thickness is indicated, it is a minimum.
- C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass[as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

PART 3 - EXECUTION

3.1 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. 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.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
- G. 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.

3.2 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. 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 buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

END OF SECTION 088000

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) CEMCO; California Expanded Metal Products Co.
- 2) ClarkDietrich Building Systems
- 3) MBA Building Supplies.
- 4) MRI Steel Framing, LLC.
- 5) Phillips Manufacturing Co.
- 6) Steel Network, Inc. (The).
- 7) Telling Industries.

- b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.

- c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) BlazeFrame Industries.
 - 2) CEMCO; California Expanded Metal Products Co.
 - 3) ClarkDietrich Building Systems.
 - 4) MBA Building Supplies.
 - 5) Metal-Lite.
 - 6) Perfect Wall, Inc.
 - 7) Steel Network, Inc. (The).
 - 8) Telling Industries.

D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich Building Systems.
 - b. MRI Steel Framing, LLC.
2. Depth: 1-1/2 inches.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

2.2 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

2.3 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. Isolation Strip at Exterior Walls: Provide the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 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. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.

- D. 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 that penetrate 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 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.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- 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 connect or suspend steel framing from ducts, pipes, or conduit.
- D. 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.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. CertainTeed Corporation.
 - c. Georgia-Pacific Building Products.
 - d. National Gypsum Company.
 - e. Temple-Inland Building Products by Georgia-Pacific.
 - f. United States Gypsum Company.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. James Hardie Building Products, Inc.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.
2. Thickness: 5/8 inch (15.9 mm).
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints 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 drying-type, all-purpose 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.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. 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.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. 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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accumetric LLC.
 - b. Franklin International.
 - c. Grabber Construction Products.
 - d. Hilti, Inc.
 - e. Pecora Corporation.
 - f. Specified Technologies, Inc.
 - g. United States Gypsum Company.
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C 840.

- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.
- D. 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.
- E. Prefill open joints and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- H. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 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.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Tile backing panels.
3. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Each type and composition of tile and for each color and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and 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 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Style and Location:

1. PCT-1

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Size: Refer to Drawings.
- d. Color: Refer to Drawings.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. CertainTeed Corp.; FiberCement BackerBoard.
 - c. National Gypsum Company, Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
- 2. Thickness: 5/8 inch (15.9 mm)
- 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.

2.5 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

- 1. Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. C-Cure.
 - d. MAPEI Corporation.
 - e. TEC; a subsidiary of H. B. Fuller Company.

2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
 - 1. Subject to compliance with requirements, provide the following:
 - a. Manufacturer: Schluter Systems L.P.
 - b. Profiles: Refer to Drawings.
 - c. Application: Refer to Drawings.
- C. Floor Sealer: Tile Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

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 the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of 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 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- 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. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain Tile: 1/8 inch.
- F. Metal Edge Strips: Install at locations indicated.
- G. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- H. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS

- A. Style and Location:
 - 1. ACP Basis-of-Design
 - a. Manufacturer: Armstrong World Industries, Inc.
 - b. Product: Optima 3250PB
 - c. Size: 24" x 24" x 1"
 - d. Color: White
 - e. Application: Refer to Drawings.

2.3 METAL SUSPENSION SYSTEM

A. Basis-of-Design

1. Manufacturer: Armstrong World Industries, Inc.
2. Product: 15/16 Prelude System
3. Finish: White.
4. Application: Refer to Drawings.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Provide additional support for other ceiling-mounted items.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
 2. In ceramic tile locations, install perimeter grid AFTER installation of ceramic tile. Ceramic tile to extend above ceiling grid.

3.3 ATTIC STOCK

- A. Contractor to provide one unopened box of extra material.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
- B. Style and Location:
 1. RB-1
 - a. Manufacturer: Refer to Drawings
 - b. Product: Refer to Drawings.
 - c. Height: Refer to Drawings.
 - d. Application: Refer to Drawings.
- C. Lengths: Coils in manufacturer's standard length.
- D. Outside Corners: Preformed.
- E. Inside Corners: Preformed.
- F. Colors: As indicated on drawings.

2.2 RUBBER MOLDING ACCESSORY

- A. Description: Rubber transition strips.

- B. Profile and Dimensions: As indicated on drawings.
- C. Locations: Provide rubber molding accessories in areas indicated on drawings.
- D. Colors and Patterns: As indicated on drawings.

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 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.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 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 Corners: Install preformed corners before installing straight pieces.

3.3 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.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

2.2 RESILIENT TILE FLOORING

A. Solid Vinyl Floor Tile Standard: ASTM F 1700.

B. Style and Location:

1. RF-1 Basis-of Design
 - a. Manufacturer: Refer to Drawings.
 - b. Product: Refer to Drawings.
 - c. Color: Refer to Drawings.

- d. Size: Refer to Drawings.
- e. Application: Refer to Drawings.

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 floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE CARPETING

- A. Style and Location:

1. CPT-1

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Color: Refer to Drawings.
- d. Size: Refer to Drawings.

2. CPT-2

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Color: Refer to Drawings.
- d. Size: Refer to Drawings.

3. CPT-3

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Color: Refer to Drawings.
- d. Size: Refer to Drawings.

4. CPT-4

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Color: Refer to Drawings.
- d. Size: Refer to Drawings.

5. WOM-1

- a. Manufacturer: Refer to Drawings.
- b. Product: Refer to Drawings.
- c. Color: Refer to Drawings.
- d. Size: Refer to Drawings.

- B. Primary Backing/Backcoating: Manufacturer's standard composite materials

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: Carpet tile manufacturer's adhesive only.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Concrete Slabs:
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- 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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. 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 096813

SECTION 099000 – PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint and coating systems on interior and exterior substrates.
 - 1. Interior paint systems.
 - a. Gypsum board; walls and ceilings.
 - 2. High-performance exterior paint and coating systems.
 - a. Galvanized steel.
 - b. Structural steel.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint and coating system and each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

- A. Paints and Coatings:
 - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications. Colors: As indicated in a color schedule.
 - 1. Twenty percent of surface area will be painted with deep tones.

2.2 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide BABAA compliant products by one of the following:
 - 1. Manufacturer: Sherwin-Williams
 - 2. Contact: James R Bergevin, Architectural Account Executive, Northern Plains
 - 3. Telephone: (612)-720-9934

2.3 INTERIOR PAINT AND COATING COMMERCIAL SYSTEMS

A. Metal: Hollow metal frames.

1. Alkyd Systems; Waterbased

a. Finish: Semi-Gloss

- 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
- 2) 2nd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
- 3) 3rd Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series (4.0-5.0 mils wet, 1.4 - 1.7 mils dry per coat).

B. Gypsum Board: Walls and ceilings, typical.

1. Latex Systems

a. Eg-Shel/Low Luster Finish Walls:

- 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).

b. Flat Finish Ceilings:

- 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
- 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series.
- 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series (4 mils wet, 1.6 mils dry per coat).

C. Gypsum Board: Walls and ceilings in restrooms.

1. Epoxy Systems; 1 Component Pre-catalyzed Waterbased

a. Eg-Shel/Low Luster Finish:

- 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
- 2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series.
- 3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series (4 mils wet, 1.5 mils dry per coat).

2.4 HIGH PERFORMANCE INTERIOR & EXTERIOR PAINT AND COATING SYSTEMS

- A. Metal: Structural Steel Columns, Beams, Miscellaneous and Ornamental Iron, Structural Iron, and Ferrous Metal.

1. Polysiloxane System; Solvent Based

- a. Finish: Gloss.

- 1) 1st Coat: S-W Macropoxy 646 Fast Cure Epoxy, B58 Series (7.0-13.5 mils wet, 5.0-10.0 mils dry per coat).
- 2) 2nd Coat: S-W Sher-loxane 800, (5.0-7.0 mils wet, 4.0-6.0 mils dry per coat).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Wood: 15 percent.
 2. Portland Cement Plaster: 12 percent.
 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

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SECTION 102223 – HANGING PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hanging panel track systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For operable panel partitions.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HANING PANELS (STATIONARY) AND TRACK SYSTEM

- A. Basis-of-Design: Flight Hanging Panels by FilzFelt, www.filzfelt.com/flight-hanging-panel; pattern inspired by starlings swirling and surging in murmuration.

1. Material: 100% Wool Design Felt, 100 percent biodegradable.
2. Panel Thickness: 3/16 in (5 mm).
3. Color: As selected from manufacturer's standard colors.
4. Color: Enzian.
5. Panel Size, Large: 5'-9" x 8'-0" (175 x 243.8 cm).
6. Hanging Method: Velcro.
7. Weighted Rod Pocket: Weighted Rod Pocket.
8. Hanging Panel Track System: Single Channel, Fixed.
9. Sliding: Stationary.
10. Mounting: Ceiling Surface Mount to Acoustical Ceiling Panel Grid.
11. Properties:
 - a. Colorfastness to Light Class: 4–5 (40 hours).
 - b. Colorfastness to Crocking: Class 3–4 (wet), Class 4–5 (dry).
 - c. Abrasion: ASTM 4966 (Martindale Abrasion Tester Method): 5,000 Grade 4, 10,000 Grade 3.5, 20,000 Grade 3.5, 40,000 Grade 3.
 - d. Breaking Strength: ASTM D 5034 (Grab Test): 243 lb (avg of warp), 214 lb (avg of weft).
 - e. Environmental: Oeko-Tex Standard 100 Certified Product Class II (100% Wool Design Felt), Meets VOC test limits for the CDPH v1.2 method (100% Wool Design Felt).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions to determine that they are suitable for installation. Proceed with installation only when unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Install units in accordance with manufacturer's instructions, approved submittals, and in proper relationship to adjacent construction.

3.3 ADJUSTING AND CLEANING

- A. Adjust units for proper position, uniform appearance and operation.
- B. Clean exposed and semi-exposed surfaces using materials acceptable to manufacturer.

END OF SECTION 102223

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial toilet accessories.
2. Diaper changing stations.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMMERCIAL TOILET ACCESSORIES

A. Manufacturers

1. Toilet and Miscellaneous Accessories:

- a. Basis-of-Design: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

- 1) AJW Architectural Products
- 2) American Specialties, Inc
- 3) Bobrick Washroom Equipment, Inc.
- 4) Bradley Corporation

B. Surface-Mounted Toilet Paper Dispenser: Owner Furnished, Contractor Installed.

C. Soap Dispenser: Owner Furnished, Contractor Installed.

D. Paper Towel Dispenser: Owner Furnished, Contractor Installed.

- E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Basis-of-Design: Bobrick, B-165.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system (no mastic allowed); No.4 finish.
- F. Grab Bars: Stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.
 - d. Basis-of Design: Bobrick, B-6808.
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted.
 - a. Basis-of-Design: Bobrick, B-270.
- H. Materials
 - 1. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 2. Stainless Steel Sheet: ASTM A666, Type 304.
 - 3. Stainless Steel Tubing: ASTM A269, Type 304 or 316.
 - 4. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
 - 5. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Finishes
 - 1. Stainless Steel: Satin finish, unless otherwise noted.

2.2 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Polyethylene.
 - 2. Mounting: Surface.
 - 3. Color: Gray.
 - 4. Minimum Rated Load: 250 pounds.
 - 5. Products:
 - a. American Specialties, Inc
 - b. Bradley Corporation

- c. Koala Kare Products.

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guards

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 FABRICATION

- A. 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.

END OF SECTION 102800

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SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire-protection cabinets for portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.

1.3 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET (FEC)

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division.
 - d. Larsens Manufacturing Company.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Solid opaque panel with frame.
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- I. Accessories:
 - 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
- J. Materials:
 - 1. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
 - a. Finish: Baked enamel or powder coat.
 - 2. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish.

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply vinyl lettering at locations indicated.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.

- b. Kidde Residential and Commercial Division.
 - c. Larsens Manufacturing Company.
- 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 1016 nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motor-operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lutron Electronics Co., Inc.
 2. MechoShade Systems, Inc.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 3. Remote Control: Group wall-switch.
 4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
 5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior face of shade.
 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material]
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 3. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
 - 3. Weave: Basketweave.
 - 4. Roll Width: As indicated on Drawings.
 - 5. Openness Factor: 1 percent.
 - 6. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

- D. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- E. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic-laminate countertops.
- B. Related Requirements:
 - 1. Section 064116 "Plastic-Laminate-Faced Architectural Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
 - 1. Plastic laminates, for each color, pattern, and surface finish.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Adhere to AWI's Quality Certification Program standards.
- B. Installer Qualifications: Adhere to AWI's Quality Certification Program standards.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
- B. Grade: Custom.

- A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- B. Colors, Patterns, and Finishes: Refer to Drawings.
- C. Edge Treatment: Same as laminate cladding.
- D. Core Material at Sinks: [Particleboard made with exterior glue] [medium-density fiberboard made with exterior glue] [or] [exterior-grade plywood].
- E. Core Thickness: 3/4 inch (19 mm).
 - 1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- F. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
- G. Paper Backing: Provide paper backing on underside of countertop substrate.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

- A. Grommets: Molded-plastic grommets and matching plastic caps with slot for wire passage.

2.4 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. If applicable, insert subparagraph to describe conditions where eased edges are not required.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

END OF SECTION 123623.13

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material chair rails.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE CHAIR RAIL MATERIALS

A. Solid Surface Material:

1. Colors and Patterns: Refer to Drawings.

2.2 COUNTERTOP FABRICATION

- A. Fabricate according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Custom.
- B. Chair Rails: 1/2-inch- (12.7-mm-) with front edge built up with same material.
- C. Joints: Fabricate without joints.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Secure chair rail to gypsum board with adhesive according to solid surface material manufacturer's written instructions.
- B. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- C. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.

B. Related Requirements:

1. Section 064116 "Plastic-Laminate-Faced Architectural Cabinets."

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate:

1. Colors and Patterns: Refer to Drawings.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 3-centimeter with front edge built up with same material.

D. Backsplashes: 3-centimeter.

E. Joints: Fabricate countertops without joints.

F. Joints: Fabricate countertops in sections for joining in field.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

B. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

D. Install backsplashes and end splashes by adhering to wall and countertop with.

E. 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.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

SECTION 210010 - FIRE SUPPRESSION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. This section applies to all work under the fire suppression contract. This shall include, but not necessarily be limited to, the following:
 - 1. Water Based Fire Suppression Systems
 - 2. Demolition of Fire Suppression Systems
- B. The work shall include all materials, equipment and labor required for complete and properly functioning fire suppression systems.
- C. Drawings for fire suppression work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and materials.
- D. Where job conditions require reasonable changes in indicated locations and arrangements, make such changes without additional cost to Owner.
- E. Because of the scale of the drawings, certain piping or items such as unions or fittings may not be shown, but where such items are required by other sections of the specifications, or where they are required by the nature of the work, they shall be furnished and installed.
- F. All elements of the construction shall be performed by workers skilled in the particular craft involved, and regularly employed in that particular craft.
- G. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. International Fire Suppression Code
 - 2. Uniform Plumbing Code
 - 3. Iowa State Plumbing Code
 - 4. International Mechanical Code
 - 5. Iowa State Mechanical Code

6. International Building Code
 7. National Electric Code (NEC)
 8. National Fire Protection Association Standards (NFPA)
 9. Local Utility Company Requirements
 10. Local Codes, all trades
 11. Standards of ASME, ASHRAE, NEMA, IEEE, AGA, SMACNA
 12. Occupational Safety and Health Administration (OSHA)
 13. Underwriters Laboratories, Inc. (U.L.)
 14. Iowa Administrative Codes
 15. Americans With Disabilities Act (ADA)
- B. Contractors shall familiarize themselves with all codes and standards applicable to their work and shall notify Design Professional of any discrepancies between the design and applicable code requirements so that any conflicts can be resolved. Where two or more codes or standards are in conflict, that requiring the highest order of workmanship shall take precedence, but such questions shall be referred to Design Professional for final decision.
- C. Where drawings or specifications call for workmanship or materials in excess of code requirements, a lower grade of construction will not be permitted.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the authorities having jurisdiction and local utility companies. Contractor shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Secure all required permits and pay for all inspections, licenses and fees required in connection with the fire suppression work. Contractor shall post all bonds and obtain all licenses required by the State, City, County and Utility.

1.5 FIRE SUPPRESSION DRAWINGS

- A. The fire suppression drawings indicate in general the building arrangement only, Contractor shall examine all construction drawings to familiarize himself with the specific type of building construction, i.e. type of structural system, floors, walls, ceilings, room finishes and elevations.
- B. Drawings for piping are intended to convey the scope of the work and to indicate the general arrangement and locations of piping and equipment.
- C. Contractor shall layout their own work and shall be responsible for determining the exact locations for equipment and rough-ins and the exact routing of piping so as to best fit the layout of the work.
- D. Contractor shall take their own field measurements for verifying locations and dimensions: scaling of the drawings will not be sufficient for laying out the work.

- E. Because of the scale of the drawings, certain basic items such as pipe fittings and valves may not be shown, but where such items are required by code or by other sections of the specifications, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact location of all existing services prior to beginning work in that area.
- B. Existing active services, i.e., water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain.
- C. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- D. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to familiarize himself with the conditions of the site which will affect their work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the work required because of the contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate their work with the schedule of General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building. Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.

- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications, or between the requirements set forth for the various contractors, shall be called to the attention of the Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by the Design Professional and their decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting and plaster until the project is substantially completed. Damage from rust, paint and scratches shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the painting contractor, but this shall not relieve Contractor of the responsibility for checking to assure that adequate protection is being provided.
- F. Where the final installation or connection of equipment in the building requires Contractor to work in finished areas of the building, Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Contractor shall arrange with General Contractor for patching and refinishing of such areas which may be damaged in this respect.

1.9 OPENINGS, CUTTING AND PATCHING

- A. Piping and sleeves passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and pipe or sleeve shall be sealed with UL listed intumescent fire barrier/ Firestopping material equivalent to rating of wall/floor. Where piping and sleeves pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk.
- B. New structure:
 - 1. Contractor will coordinate the placing of openings and lintels in the new structure as required for the installation of the fire suppression work with the General Contractor.
 - 2. Contractor shall furnish to General Contractor the accurate locations and sizes for required openings, but this shall not relieve Contractor of the responsibility of checking to assure that proper size openings are provided. When additional cutting and patching is required due to Contractor's failure to coordinate this work, Contractor shall make arrangements for the cutting, patching, and painting required.

C. Existing Structure:

1. Contractor shall provide cutting, lintels and patching, and patch painting in the existing structure, as required for the installation of their work, and shall furnish lintels and supports as required for openings.
2. Cutting of structural support members will not be permitted without prior approval of the Design Professional. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings.
3. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.10 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable U.S.A. manufacturer regularly engaged in the manufacture of the specified item. Where two or more units are required of the same item, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items, when required, shall be furnished as part of the equipment, whether or not specifically called for.

1.11 SUBMITTALS

- A. Contractor shall furnish to Design Professional, complete, reviewed and stamped/signed electronic submittal data. I. Refer to Division 01 for submittal general requirements and individual specification sections for additional detailed requirements.
- B. Shop drawings shall cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal submittals are not acceptable.
- C. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- D. After award of contract, Contractor shall provide a completed submittal schedule including dates that the submittals will be to Design Professional for review.
- E. Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- F. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to Design Professional in bookmarked pdf and duplicate printed hard copy upon completion of the job. Refer to Division 01 specifications for additional information.
- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three-ring hard-backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
FIRE SUPPRESSION SYSTEMS

(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME AND ADDRESS OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Use plastic tab indexes for sections of manual. Each section shall contain the following information for equipment furnished under this contract:
 - 1. Equipment and system warranties and guarantees.
 - 2. Installation instructions.
 - 3. Operating instructions.
 - 4. Maintenance instructions.
 - 5. Spare parts identification and ordering list.
 - 6. Local service organization, address, contract and phone number.
 - 7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.
 - 8. Reports of all tests and demonstrations including certificate of owner instruction, testing and balancing report, etc.

1.13 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the fire suppression installation, Contractor shall provide to Owner, or their designated representatives, all comprehensive training on essential features and functions of all systems installed, and shall instruct Owner in the proper operation and maintenance of such systems.
 - 1. Provide adequate notice to Owner as to when instruction will be conducted so appropriate personnel can be present.
 - 2. Prepare the instruction format for a minimum of four Owner Representatives.

- B. Contractor shall submit to Design Professional a certificate, signed by Owner stating the date, time and persons instructed and that the instruction has been completed to the Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that the contractor has demonstrated the hereafter listed systems to Owner's representatives in accordance with the Contract documents and that the instruction has been completed to the Owner's satisfaction.

A. Project:

B. System(s):

C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

E. Acknowledgement of demonstration:

Contractor's Representative:

signature

date

Owner's Representative:

signature

date

1.14 SUBSTITUTIONS

- A. Refer to Divisions 00 and 01.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.15 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer, model, type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plan schedules are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of the contractor and/or the manufacturer.
- C. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions (including accessibility for maintenance), operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
- D. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.16 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.

- b. The entire Fire Suppression system, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 21 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.17 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by Owner.
- B. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

1.18 CLEANING

- A. At the conclusion of the construction, the system equipment shall be cleaned. Refer to 211000 for system flushing requirements.
- B. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. Name plates, ratings, instruction plates, etc., shall not be obscured by paint, insulation, or placement of units.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 210010

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 GENERAL

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 210010 - Fire Suppression General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the following:
 - 1. Sleeves
 - 2. Escutcheons
 - 3. Demolition

PART 2 - PRODUCTS

2.1 DEMOLITION MATERIALS

- A. All materials removed shall be the property of the removing contractor and shall be removed from the site by him, unless otherwise specified.

2.2 SLEEVES

- A. Sleeves passing through non load bearing walls and partitions shall be galvanized sheet steel with lock seam joints of minimum gauges as follows:
 - 1. For pipes 2 1/2" and smaller 24 gauge
 - 2. For pipes 3" to 6" 22 gauge
 - 3. For pipes over 6" 20 gauge
- B. Sleeves passing through load bearing walls, concrete beams, fireproof walls, foundations, footings and waterproof floors shall be Schedule 40 steel pipe or cast iron pipe.
- C. Sleeves are not required in masonry walls which are core drilled or walls of drywall construction, except where partition is a firestop, smokestop, or side of air plenum.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.

- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water and fill space between sleeves and pipe with graphite packing and caulking compound.

2.3 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished spaces. Escutcheons shall fit around pipe; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve with set screws or other approved devices.

PART 3 - EXECUTION

3.1 DEMOLITION

A. General

1. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
2. Contractor shall remove existing equipment and piping not necessary for additions or existing portions of building as indicated on drawings and/or specified herein. To include all abandoned equipment and piping back to point of origin. Demolition of equipment shall include removal of associated concrete equipment pad and/or support steel.
3. Contractor shall be responsible for the cutting and capping of all existing services before any work is commenced by the General Contractor.

- B. Work by Others: Unless specifically noted under other contracts, Contractor shall assume all required work shall be performed by him. In general, the following will be performed by others:

1. General Contractor will remove any floors, walls and ceilings, neatly patch, match, complete and finish all affected surfaces.
2. Electrical Contractor will disconnect all electrical services and remove abandoned conduit back to point of origin.

C. Existing Conditions:

1. If any piping serving existing fixtures or equipment which are to remain are disturbed by operations under this Contract, Contractor shall provide pipe and insulation required to reestablish continuity of such piping systems.
2. Contractor shall arrange for General Contractor to repair, patch and paint all construction, with material necessary to match surrounding material, which is necessary due to removal of equipment and piping.

3. Contractor shall furnish all required labor and material where required to extend new work to connect to similar work where new addition adjoins existing building and for extension of existing system. Connection shall be made in a suitable manner.

- D. Owner's Right of Salvage: The Owner may designate and have salvage rights to any material herein demolished by the Contractor.

3.2 SLEEVES

- A. Install sleeves for all piping passing through floors, roof, walls, concrete beams and foundations as required by this section.

3.3 ESCUTCHEONS

- A. Install escutcheons for all pipes entering finished spaces.

END OF SECTION 210500

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SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 210010 - Fire Suppression General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Identification shall be provided for all Fire Suppression piping and equipment as indicated by this section, on drawings and/or specified in other Division 21 sections.
- B. Type of identification devices specified in this section include the following:
 - 1. Plastic pipe markers
 - 2. Plastic tape
 - 3. Valve tags
- C. Identification furnished as part of factory fabricated equipment, is specified as part of the equipment assembly in other Division 21 sections.

1.3 QUALITY ASSURANCE

- A. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Pipe marker material, color, and nomenclature.
 - 2. Valve tag material, color, and nomenclature.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

B. Provide closeout items containing the following:

1. Schedules: Submit valve schedule for each piping system, formatted in an Excel spreadsheet with a digital copy provided to the Owner along with a printed copy on 8 1/2" x 11" paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut off and similar special uses, by special "flags", in margin of schedule. In addition, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 21 sections. Where more than one single type is specified for an application, selection is Installer's option, but provide single selection for each product category.

B. Plastic Pipe Markers:

1. General: Provide manufacturer's standard preprinted flexible or semi rigid, permanent, color coded, plastic sheet pipe markers, complying with ANSI A13.1.
2. Small Pipes: For external diameters not greater than 6" (including insulation if any), provide full band pipe markers extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap on application of pre tensioned semi rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 3/4" wide full circle at both ends of pipe marker, tape lapped 1 1/2".
3. Lettering: Manufacturer's standard preprinted nomenclature which best describes piping system in each instance, as selected by Design Professional in cases of variance with names as shown or specified.
4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

C. Plastic Tape:

1. General: Manufacturer's standard color coded pressure sensitive (self adhesive) vinyl tape, not less than 3 mils thick.
 - a. Width: Provide 1 1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2 1/2" wide tape for larger pipes.
 - b. Color: Comply with ANSI A13.1, except where another color selection is indicated.

D. Valve Tags:

1. Brass Valve Tags: Provide polished brass valve tags with stamp engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 7/16" high, and with 3/16" hole for fastener. Tag thickness 0.040 inches.
 - a. Provide 2" diameter tags, except as otherwise indicated.
 - b. Fill tag engraving with black enamel.
2. Plastic Valve Tags: Provide red heavy plastic tag with 7/16" white embossed sequenced numbers.
3. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S hooks or heat sealed braided copper wire of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.2 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in fire suppression identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of fire suppression systems and equipment.
 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Fire Pump, Standpipe F12).

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces which require painting or other covering or finish including valve tags, install identification after completion of covering and painting if any. Install identification prior to installation of acoustical ceilings and similar concealment.

B. Piping System Identification:

1. General: Install pipe markers of one of the following types on all fire suppression piping, and include arrows to show normal direction of flow:
 - a. Stenciled markers, including color coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
 - b. Plastic pipe markers, with application system as indicated under "Materials" in this section.
 - c. Stenciled markers, black or white for best contrast, wherever continuous color coded painting of piping is provided.

2. Locate pipe markers, color bands, and flow direction arrows at all installations of piping, including all exposed piping, piping above all ceilings (both accessible and inaccessible ceilings), and piping within view of any points of access (access doors, manholes, etc.). The only locations where pipe labels are not required are on piping concealed behind or within inaccessible walls and within inaccessible chases or shafts. When installing markers, bands, and arrows, they shall be installed to meet the following provisions:
 - a. Near each valve and control device.
 - b. Near locations where pipes pass through walls or floors/ceilings, or enter non accessible enclosures.
 - c. At access doors, manholes and similar access points which permit view of concealed piping.
 - d. Near major equipment items and other points of origination and termination.
 - e. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
 - f. Visible from the floor.

C. Valve Identification:

1. General: Provide valve tag on every valve, cock and control device in fire suppression piping system; exclude check valves. List each tagged valve in valve schedule for each piping system.

END OF SECTION 210553

SECTION 211000 – WATER-BASED FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 210010 - Fire Suppression General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of fire suppression work is indicated on drawings and schedules, and by requirements of this section.
- B. Applications of fire suppression systems include the following:
 - 1. Sprinkler systems.

1.3 QUALITY ASSURANCE

- A. NFPA Code: Comply with ANSI/NFPA 13, "Installation of Sprinkler Systems", and ANSI/NFPA 24, "Private Fire Service Mains and Their Appurtenances", where applicable.
- B. UL Labeling: Provide fire sprinkler piping products which have been approved and labeled by Underwriters Laboratories.
- C. FM Approval: Provide fire sprinkler piping products which have been approved by Factory Mutual.
- D. Local Fire Marshal Regulations: Comply with governing regulations pertaining to fire sprinkler piping.
- E. State Fire Marshal's Office Regulations: Comply with governing regulations pertaining to fire sprinkler piping.
- F. All fire suppression work shall be performed by a qualified sprinkler contractor with at least three years experience that has obtained current certification in the State of Iowa under the Fire Extinguishing System Contractor Certification program. During the installation, a minimum of one person with at least three years sprinkler experience shall be present.
- G. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- H. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Provide one submittal containing the following information:
 - 1. Product Data: Submit manufacturer's data for fire suppression system components, materials, and devices.
 - 2. Piping Shop Drawing and Hydraulic Calculations: The Contractor shall prepare a complete set of detailed working drawings and hydraulic calculations showing all equipment, fire service lines, risers, piping and heads. These drawings and calculations shall be approved in writing or stamped approved by the authorities having jurisdiction. [State Fire Marshal as the authority having jurisdiction, Factory Mutual]. Contractor is responsible for any fees associated with the review and approval of the fire suppression layout drawings, product data and hydraulic calculations by the State Fire Marshal's office. Contractor is also responsible for completion of the required fire extinguishing system submittal form to the SFM. This form is available from the State at the following website: <http://www.dps.state.ia.us/fm/building/forms.shtml>.
 - 3. Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
 - 4. Grooved joint couplings and fittings shall be referred to on drawings and product submittals and be identified by the manufacturer's listed model or series designation.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings (if required)
 - b. Include manufacturer's maintenance information.
 - c. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - 2. Include startup and test reports. Submit reports immediately upon completion of tests.
 - 3. Certificate of Demonstration: Submit certification upon completion of fire suppression piping work which indicates that work has been tested in accordance with ANSI/NFPA 13 (Factory Mutual) and also that system is operational, complete and has no defects. (Submit all documentation as required by Factory Mutual).
 - 4. Manufacturer's Warranty: Submit manufacturers standard warranty document.
 - 5. As-builts.

6. Stock Materials: Provide a list of stock materials for owner to verify and sign for acknowledgement of receiving.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire Suppression Specialties

1. Reliable Sprinkler Corporation.
2. Tyco.
3. Viking Corp.
4. Globe Fire Sprinkler Corporation
5. Victaulic
6. Potter
7. System Sensor

B. Gate Valves

1. NIBCO
2. Powell
3. Milwaukee
4. Watts
5. Victaulic

C. Bronze Body Butterfly Valves

1. NIBCO
2. Milwaukee

D. Butterfly and Swing Check Valves

1. Victaulic
2. Gruvlok by Anvil International
3. Kennedy
4. Milwaukee
5. NIBCO

E. Ball Valves

1. Watts B-6000 Series
2. Milwaukee BA-100/BA-150
3. NIBCO T-580 Series
4. Apollo 77C Series
5. Victaulic

F. Grooved Piping Systems

1. Gruvlok by Anvil International
2. Victaulic

2.2 FIRE SUPPRESSION SPECIALTIES

- A. General: Provide fire suppression specialties, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.
1. Automatic Sprinklers:
 - a. Provide automatic sprinklers of type indicated on drawings, and in accordance with the following listing. Provide liquid bulb, ordinary temperature, except where intermediate or high temperature rated sprinklers are required per NFPA 13 or as indicated on the plans.
 - 1) Upright
 - 2) Concealed Pendent with Flat Cover Plate
 - 3) Pendent
 - b. Finish: Painted white for concealed pendent, cast brass for upright pendent, [white] for recessed pendent or provide finish as indicated on the plans.
 2. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store 10 sprinklers and wrench sized to sprinklers.
 3. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
 4. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss cast in the sprinkler body.

2.3 VALVES

- A. Butterfly - 1/4" to 2" Milwaukee Butterball BB2 Series
- B. Ball - 2" to 3" Victaulic Series 727
- C. Butterfly - 4" to 8" Victaulic Series 705 (Normally Open Valves) or Series 707C (Normally Closed Valves)
- D. Gate - 2-1/2" and larger, iron body O.S.&Y., Powell Fig. 1797
- E. Check - 2-1/2" to 3", Central Model 90, 4" to 8" Victaulic Series 717

2.4 PIPE MATERIALS

	<u>Material</u>	<u>Service</u>
A.	Black steel pipe, Schedule 10, ASTM A795	Wet systems.
B.	Flexible sprinkler head connectors are <u>not</u> allowed.	

2.5 PIPE FITTINGS

A. Steel Pipe:

1. Threaded pipe (2" dia and smaller): Malleable or Ductile iron fittings, 150 pound standard flat band water pattern.
2. Welded pipe (2 1/2" dia and larger): Standard radius weld fittings and weld neck or slip-on flanges, same material and strength as pipe.
3. Mechanical grooved and roll-groove steel piping system and fittings: may be used as approved by code for black steel, stainless steel and galvanized steel. All components shall be by one manufacturer. System installation shall be in accordance with the manufacturer's recommendations.
 - a. In lieu of groove type couplings and fittings, Victaulic Installation-Ready™ fittings for Schedule [40] [10] grooved end steel piping in fire protection applications sizes NPS 1-1/4" thru 2 1/2", consisting of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, prelubricated Grade "E" EPDM Type 'A' gasket, and ASTM A449 electroplated steel bolts and nuts. UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).
 - b. Grooved joint fittings shall be ductile iron conforming to ASTM A-536 Grade 65-45-12, short-pattern with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock.

2.6 JOINTS

A. Steel Pipe:

1. Threaded pipe (2" dia and smaller): Make joints using Teflon tape applied to male threads only. Cut pipe square, cut threads clean, remove burrs and ream ends to full size of bore.
2. Welded pipe (2 1/2" dia and larger): Welding shall conform to welding section of ANSI-B31.3 "Code for Power Piping."
3. Mechanical grooved and roll-groove pipe couplings: Grooved couplings may be used as approved by code for black steel and galvanized steel piping. Gasket type to be used shall be appropriate for intended service. All components shall be by one manufacturer. System installation shall be in accordance with the manufacturer's recommendations.
 - a. In lieu of groove type couplings and fittings, Victaulic Installation-Ready™ fittings for Schedule 10 grooved end steel piping in fire protection applications sizes NPS 1-1/4" thru 2 1/2", consisting of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, prelubricated Grade "E" EPDM Type 'A' gasket, and ASTM A449 electroplated steel bolts and nuts. UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).
 - b. Grooved joint fittings shall be ductile iron conforming to ASTM A-536 Grade 65-45-12, short-pattern with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock.

2.7 NIPPLES AND UNIONS

- A. All nipples shall conform to size, weight and strength of adjoining pipe. When length of unthreaded portion of nipple is less than 1-1/2", use extra strong nipple; do not use close nipples.
- B. For pipe 2" and smaller, use screwed unions, for pipe 2-1/2" and over use flanged unions. For steel pipe use black or galvanized malleable iron unions, to conform to pipe with ground joint. Cast iron flanged unions gasket type. For threaded brass pipe, use bronze ground joint unions with octagon ends.
- C. Install unions in the following locations so that a minimum amount of pipe need be disassembled:
 - 1. Long runs, at intervals of 80 feet.
 - 2. In by-pass around equipment, valves, and controls.
 - 3. In connections to equipment.
 - 4. Where indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor shall familiarize himself with the general construction, plumbing, heating, ventilating, and electrical work and to use the information to avoid conflicts in space allocation with the other trades. Do not place pipes over electrical equipment.
- B. In the case of an interference occurring during construction, Contractor shall rework and reinstall piping and equipment in order to make space available for another contractor's equipment without additional cost to the Owner.
- C. Contractor shall work closely with the ceiling system installers and install sprinkler head drops before ceiling tiles are installed, and return to job after or during ceiling tile installation for installation of sprinkler heads.
- D. Heads shall be located in center of ceiling tiles or as directed by Design Professional.

3.2 FIRE SUPPRESSION SPECIALTIES

- A. General: Install fire suppression specialties as indicated, and in accordance with ANSI/NFPA 13.
- B. Provide wire guards for all exposed sprinkler heads installed in gymnasiums, below ductwork in mechanical rooms, in electrical rooms, in telecommunication rooms, and locations where heads are susceptible to mechanical damage (e.g. within seven feet of floor level).

3.3 VALVES

- A. Install valves as indicated on the drawings and as specified herein. Install sectional valves in inlet piping at bottom of each riser and in loops as indicated. Locate valves for easy access and operation. Do not locate valves with stems below horizontal. Mount supervisory switches on each sectional valve.
- B. Install valves in equipment rooms to provide easy access to valve. Each valve installed 8'-0" above the floor shall be provided with chain operator. Bottom of chain operator shall be 7'-0" above floor.
- C. Check valves shall not be installed in vertical runs of piping unless they are specifically designed for vertical operation.

3.4 PIPING

- A. General: Comply with requirements of ANSI/NFPA 13 for installation of fire sprinkler piping products where indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves intended purposes.
- B. Arrange and install piping approximately as indicated; straight, plumb, and as direct as possible; form right angles on parallel lines with building walls. Keep pipes close to walls and avoid interference with other mechanical items. Locate groups of pipes parallel to each other; space at a distance to permit access for servicing valves. Most piping to be run in concealed locations unless indicated exposed, or in equipment rooms. Locate piping to avoid ductwork.
- C. Install horizontal piping as high as possible without sags or humps so that proper grades can be maintained for drainage. Install drain piping at low points of fire sprinkler piping.
- D. Install valved hose connections of sizes indicated, or 3/4" size if not otherwise indicated, on sprinkler at ends of branch lines and cross mains at locations where indicated.
- E. Install air vents at high points of sprinkler piping.
- F. Hangers and supports: Comply with NFPA for hanger materials
 - 1. Install sprinkler system piping according to NFPA 13.
- G. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

3.5 ADJUST AND CLEAN

- A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in ANSI/NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.6 FIELD QUALITY CONTROL

- A. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically, for period of 2 hours, at not less than 200 psi or at 50 psi in excess of maximum static pressure when maximum static pressure is in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.
- B. Repair or replace piping system as required to eliminate leakage in accordance with ANSI/NFPA standards for "little or no leakage", and retest as specified to demonstrate compliance.

3.7 TRAINING AND DEMONSTRATIONS

- A. Equipment training:
 - 1. Contractor shall provide instruction and training on all fire suppression system components.
 - 2. Training sessions shall use the printed installation, operation and maintenance instruction materials included in the O&M manuals and emphasize preventative maintenance and safe operating procedures.
 - 3. Training shall be performed by qualified factory trained technicians.
 - 4. Contractor shall attend all sessions performed by the manufacturer's representative and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
 - 5. Equipment training shall occur as soon as possible after start up of the equipment and shall include hands-on operation.

3.8 EXTRA STOCK

- A. General: For each style and temperature range required, furnish additional sprinkler heads, amounting to 1 unit for every 100 installed units, but not less than 5 units of each.

END OF SECTION 211000

SECTION 220010 - PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. This section applies to all work under the plumbing contract. This shall include, but not necessarily be limited to, the following:
 - 1. Waste and Vent Systems
 - 2. Hot and Cold Water Distribution System
 - 3. Plumbing Fixtures
 - 4. Sanitary Sewer
 - 5. Piping Insulation
 - 6. Natural Gas System
- B. The work shall include all materials, equipment and labor required for complete and properly functioning plumbing systems.
- C. Drawings for plumbing work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and materials.
- D. Where job conditions require reasonable changes in indicated locations and arrangements, make such changes without additional cost to Owner.
- E. Because of the scale of the drawings, certain piping or items such as unions or fittings may not be shown, but where such items are required by other sections of the specifications, or where they are required by the nature of the work, they shall be furnished and installed.
- F. All elements of the construction shall be performed by work skilled in the particular craft involved, and regularly employed in that particular craft.
- G. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. International Fire Suppression Code

2. Uniform Plumbing Code
 3. Iowa State Plumbing Code
 4. International Mechanical Code
 5. Iowa State Mechanical Code
 6. International Building Code
 7. National Electric Code (NEC)
 8. National Fire Protection Association Standards (NFPA)
 9. Local Utility Company Requirements
 10. Local Codes, all trades
 11. Standards of ASME, ASHRAE, NEMA, IEEE, AGA, SMACNA
 12. Occupational Safety and Health Administration (OSHA)
 13. Underwriters Laboratories, Inc. (U.L.)
 14. Iowa Administrative Codes
 15. Americans With Disabilities Act (ADA)
 16. ANSI/NSF 372
- B. Contractors shall familiarize themselves with all codes and standards applicable to their work and shall notify Design Professional of any discrepancies between the design and applicable code requirements so that any conflicts can be resolved. Where two or more codes or standards are in conflict, that requiring the highest order of workmanship shall take precedence, but such questions shall be referred to Design Professional for final decision.
- C. Where drawings or specifications call for workmanship or materials in excess of code requirements, a lower grade of construction will not be permitted.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the authorities having jurisdiction and local utility companies. Contractor shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Secure all required permits and pay for all inspections, licenses and fees required in connection with the plumbing work. Contractor shall post all bonds and obtain all licenses required by the State, City, County and Utility.
- C. Contractor shall make all arrangements with each utility company and pay all service charges associated with new service.

1.5 PLUMBING DRAWINGS

- A. The plumbing drawings indicate in general the building arrangement only, Contractor shall examine construction drawings to familiarize himself with the specific type of building construction, i.e. type of structural system, floors, walls, ceilings, room finishes and elevations.
- B. Drawings are intended to convey the scope of the work and to indicate the general arrangement and locations of piping and equipment.

- C. Contractor shall layout their own work and shall be responsible for determining the exact locations for equipment and rough-ins and the exact routing of piping so as to best fit the layout of the work.
- D. Contractor shall take their own field measurements for verifying locations and dimensions: scaling of the drawings will not be sufficient for laying out the work.
- E. Because of the scale of the drawings, certain basic items such as pipe fittings and valves may not be shown, but where such items are required by code or by other sections of the specifications, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact location of all existing services prior to beginning work in that area.
- B. Existing active services, i.e., water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain.
- C. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- D. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to familiarize himself with the conditions of the site which will affect their work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate their work with the schedule of the General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building. Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.

- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications or between the requirements set forth for the various contractors shall be called to the attention of Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by Design Professional and their decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting and plaster until the project is substantially completed. Damage from rust, paint and scratches shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the Painting Contractor, but this shall not relieve Contractor of the responsibility for checking to assure that adequate protection is being provided.
- F. Where the final installation or connection of equipment in the building requires Contractor to work in finished areas of the building, Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Contractor shall arrange with the General Contractor for patching and refinishing of such areas which may be damaged in this respect.

1.9 OPENINGS, CUTTING AND PATCHING

- A. Piping and sleeves passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and pipe and/or sleeve shall be sealed with UL listed intumescent fire barrier material equivalent to rating of wall/floor. Where piping and sleeves pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk.
- B. New structure:
 - 1. Contractor will coordinate the placing of openings and lintels in the new structure as required for the installation of the plumbing work with the General Contractor.
 - 2. Contractor shall furnish to General Contractor the accurate locations and sizes for required openings, but this shall not relieve Contractor of the responsibility of checking to assure that proper size openings are provided. When additional cutting and patching is required due to Contractor's failure to coordinate this work, Contractor shall make arrangements for the cutting, patching, and painting required.
- C. Existing Structure:
 - 1. Contractor shall provide cutting, lintels and patching, and patch painting in the existing structure, as required for the installation of their work, and shall furnish lintels and supports as required for openings.

2. Cutting of structural support members will not be permitted without prior approval of the Design Professional. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings.
3. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.10 EXCAVATING AND BACKFILLING

- A. Contractor shall do all excavating necessary for sanitary sewers, storm sewers, water piping, gas piping, etc., and shall backfill trenches and excavations after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way, except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary.
- B. Backfill about the structure shall be placed, when practical, as the work of construction progresses. Backfilling on or against concrete work shall be done only when directed. Backfilling of trenches shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six (6) inches above existing grades. In backfilling trenches, selected material shall be compacted firmly around and to a depth of not less than six (6) inches over the top of work in trench. All fill and backfill and rough grading shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades. All fill and backfill shall be sand or pit run sand/gravel graded from 1" size downward, if excavated material is not suitable for backfill.

1.11 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable U.S.A. manufacturer regularly engaged in the manufacture of the specified item. Where two or more units are required of the same item, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items, when required, shall be furnished as part of the equipment, whether or not specifically called for.

1.12 SUBMITTALS

- A. Contractor shall furnish, to Design Professional, complete sets of shop drawings and other submittal data. Contractor shall review and sign shop drawings before submittal. Refer to Division 01 specifications for additional requirements.

- B. Shop drawings shall be bound into sets and cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal or unbound submittals will be rejected.
- C. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- D. After award of contract, Contractor shall provide a completed submittal schedule including dates that the submittals will be to Design Professional for review.
- E. Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- F. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to Design Professional in bookmarked pdf and duplicate printed hard copy upon completion of the job. Refer to Division 01 specifications for additional information.
- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three ring hard-backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
PLUMBING SYSTEMS
(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME AND ADDRESS OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Use plastic tab indexes for sections of manual. Each section shall contain the following information for equipment furnished under this contract:
 - 1. Equipment and system warranties and guarantees.
 - 2. Installation instructions.
 - 3. Operating instructions.
 - 4. Maintenance instructions.
 - 5. Spare parts identification and ordering list.
 - 6. Local service organization, address, contract and phone number.
 - 7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.

8. Reports of all tests and demonstrations including certificate of owner instruction, testing and balancing report, etc.

1.14 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the plumbing installation, Contractor shall provide to Owner, or their designated representatives, all comprehensive training on essential features and functions of all systems installed, and shall instruct Owner in the proper operation and maintenance of such systems.
 1. Provide adequate notice to Owner as to when instruction will be conducted so appropriate personnel can be present.
 2. Prepare the instruction format for a minimum of four Owner Representatives.
- B. System training:
 1. These sessions shall include hands-on demonstrations of system wide start-up, operation in all possible modes, shut-down and emergency procedures.
 2. System training shall include, but not be limited to, valve locations, system routing, and air/water flow patterns, system start-up/shut-down/emergency procedures.
- C. Contractor shall submit to Design Professional a certificate, signed by Owner stating the date, time and persons instructed and that the instruction has been completed to Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that Contractor has demonstrated the hereafter listed systems to Owner's representatives in accordance with the Contract documents and that the instruction has been completed to Owner's satisfaction.

A. Project:

B. System(s):

C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

E. Acknowledgement of demonstration:

Contractor's Representative:

Signature

date

Owner's Representative:

signature

date

1.15 SUBSTITUTIONS

- A. Refer to Divisions 00 and 01.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.16 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer, model, type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plan schedules are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of Contractor and/or the manufacturer.
- C. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions (including accessibility for maintenance), operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
- D. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.17 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.

- b. The entire Plumbing system, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 22 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.18 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by Owner.
- B. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

1.19 CLEANING

- A. At the conclusion of the construction, the entire system of piping and equipment shall be cleaned internally.
- B. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. Name plates, ratings, instruction plates, etc., shall not be obscured by paint, insulation, or placement of units.
- C. Before being placed in service, all domestic water distribution systems, including those for cold water and hot water shall be chlorinated as required per Section 221116 - Domestic Water Piping.

1.20 ELECTRICAL WORK

- A. Electrical work and equipment provided by Contractor shall include the following:
 - 1. Starters and disconnects for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 2. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. All control wiring in accordance with the requirements of Division 26.

- B. Electrical Contractor shall provide all power wiring for plumbing equipment, including services for motors and equipment furnished by the plumbing contractor. Motor and equipment locations are shown on the electrical drawings.
- C. Electrical Contractor shall make final connections for all motors and equipment furnished by the plumbing contractor.
- D. Electrical Contractor shall furnish safety disconnects and starters for all motors and equipment furnished by the plumbing contractor (unless specifically indicated to be furnished integrally with the equipment), so as to make service complete to each item of equipment.
- E. Contractor shall consult with Electrical Contractor prior to conduit rough-in and shall verify with him the exact locations for rough-ins, and the exact size and characteristics of the services required, and shall provide Electrical Contractor a schedule of electrical loads for the equipment furnished by him. These schedules will be used for sizing services, disconnects, fuses, starters and overload protection.

1.21 TEMPORARY UTILITIES

- A. Refer to Division 01 for specific requirements concerning temporary utilities.

END OF SECTION 220010

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the following:
 - 1. Demolition
 - 2. Sleeves
 - 3. Escutcheons

PART 2 - PRODUCTS

2.1 DEMOLITION MATERIALS

- A. All materials removed shall be the property of the removing contractor and shall be removed from the site by him, unless otherwise specified.

2.2 SLEEVES

- A. Sleeves passing through non load bearing walls and partitions shall be galvanized sheet steel with lock seam joints of minimum gauges as follows:
 - 1. For pipes 2 1/2" and smaller 24 gauge
 - 2. For pipes 3" to 6" 22 gauge
 - 3. For pipes over 6" 20 gauge
- B. Sleeves passing through load bearing walls, concrete beams, fireproof walls, foundations, footings and waterproof floors shall be Schedule 40 steel pipe or cast iron pipe.
- C. Sleeves are not required in masonry walls which are core drilled or walls of drywall construction, except where partition is a firestop, smokestop, or side of air plenum.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.

- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water and fill space between sleeves and pipe with graphite packing and caulking compound.

2.3 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

PART 3 - EXECUTION

3.1 DEMOLITION

A. General:

1. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
2. Contractor shall remove existing equipment and piping not necessary for additions or existing portions of building as indicated on drawings and/or specified herein. To include all abandoned equipment and piping back to point of origin. Demolition of equipment shall include removal of associated concrete equipment pad and/or support steel.
3. Contractor shall be responsible for the cutting and capping of all existing services before any work is commenced by the General Contractor.

- B. Work by Others: Unless specifically noted under other contracts, Contractor shall assume all required work shall be performed by him. In general, the following will be performed by others:

1. General Contractor will remove any floors, walls and ceilings, neatly patch, match, complete and finish all affected surfaces.
2. Electrical Contractor will disconnect all electrical services and remove abandoned conduit back to point of origin.

C. Existing Conditions:

1. If any piping serving existing fixtures or equipment which are to remain are disturbed by operations under this Contract, Contractor shall provide pipe and insulation required to reestablish continuity of such piping systems.
2. Contractor shall arrange for General Contractor to repair, patch and paint all construction, with material necessary to match surrounding material, which is necessary due to removal of equipment and piping.

3. Contractor shall furnish all required labor and material where required to extend new work to connect to similar work where new addition adjoins existing building and for extension of existing system. Connection shall be made in a suitable manner.

- D. Owner's Right of Salvage: The Owner may designate and have salvage rights to any material herein demolished by the Contractor.

3.2 SLEEVES

- A. Install sleeves for all piping passing through floors, roof, walls, concrete beams and foundations as required by this section.

3.3 ESCUTCHEONS

- A. Install escutcheons for all pipes entering finished spaces.

END OF SECTION 220500

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SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary to install valves as required by the drawings and this section.

1.3 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturers cut sheets and schedules including physical dimensions, construction materials, and pressure and temperature ratings.

1.4 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

1.5 QUALITY ASSURANCE

- A. ANSI/NSF 372 Certification: All potable water supply piping valves (excluding main gate valves greater than 2") shall meet the requirements of ANSI/NSF 372 Certification, Drinking Water System Components, Lead Content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Gate Valves and Check Valves

1. NIBCO
2. Powell
3. Milwaukee
4. Watts
5. Clow

B. Ball Valves

1. Watts
2. Milwaukee
3. NIBCO
4. Apollo
5. Viega

C. Domestic Hot Water Recirculation Balancing Valves

1. Taco
2. Bell & Gossett
3. Wheatley
4. Armstrong
5. Flow Design Inc. (Flow Set)
6. Griswold
7. NIBCO

D. All valves of same type shall be of the same manufacturer unless otherwise specified in this section or on the drawings.

E. Model numbers in valve schedule based on NIBCO, unless noted otherwise.

2.2 VALVE CONSTRUCTION

A. Gate valves shall have solid tapered wedge, except where otherwise specified.

B. Check Valves: 2" and smaller, horizontal swing type with Teflon seat, bronze lead free body. 200 psi, CWP and 300 deg. F maximum temperature. 2-1/2" and larger, flanged silent check type with bronze mounted bolted bonnet and renewable seat and disc, ductile iron body, 150 psi at 366 deg F conforming to MSS SP-136.

C. Ball Valves 4" and smaller: Bronze or brass two-piece with stainless steel ball, teflon seats and stuffing box ring, vinyl insulated lever handle.

1. Full port for valves 2-1/2" and smaller.
2. Standard port for valves 3" and larger.

- D. Domestic hot water recirculation balancing valves: Bell & Gossett Model CB “Circuit Setter” or equal.
1. Ball type valve with brass body and stainless-steel ball construction, glass and carbon fitted TFE seat rings, extended readout ports with integral check valves and gasketed caps, drain port, calibrated nameplate and position indicator, memory stops, and NPT connectors, rated for 300 psig at 250°F.
 2. Valves to seal leak-tight at maximum rated working pressure.
 3. Valves to be selected for 5 ft. pressure drop at full open setting and design water flow.

2.3 VALVE SCHEDULE

- A. Furnish valves as per the following schedule:

<u>Service</u>	<u>Valve type</u>
Domestic hot and cold-water pressures up to 200 psi	Ball - 2-1/2" and smaller, S-685-66-LF (bronze)/S-FP600A-LF (brass) Ball - 3" and 4", T-FP600A-LF Check - 2" and smaller, T/S413Y-LF 2-1/2" and larger, 910-LF
Domestic hot water recirculation valves	All sizes – Bell & Gossett Model CB circuit setter.

- B. Valves installed on all systems with insulated piping shall be provided with valve handle extensions and/or extended neck design to facilitate installation of insulation and make handles operable without damage to the insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves in accessible location in general locations indicated on the drawings and as called for in other sections.
- B. Check valves shall not be installed in vertical runs of piping unless they are specifically designed for vertical operation.

END OF SECTION 220523

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide materials, equipment, labor and supervision necessary to install hangers, supports, anchors, guides and seals as required by the drawings and this section.
- B. Types of supports, anchors and seals specified in this section include the following:
 - 1. Horizontal Piping Hangers and Supports.
 - 2. Vertical Piping Clamps.
 - 3. Hanger Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Anchors.

1.3 QUALITY ASSURANCE

- A. Code Compliance: Comply with applicable plumbing and mechanical codes pertaining to product materials and installation of supports, anchors and seals.
- B. UL and FM Compliance: Provide products which are Underwriters Laboratories listed and Factory Mutual approved.
- C. ANSI Compliance: All supports and parts shall conform to the latest requirements of the ANSI Code for Pressure Piping B31.1.0 except as supplemented or modified by the requirements of this specification.

PART 2 - PRODUCTS

2.1 HANGERS, SUPPORTS AND ACCESSORIES (Reference Catalog Figure numbers from Anvil)

- A. Pipe support systems shall secure pipes in place, prevent pipe vibration, provide vertical adjustment for maintaining required grades, and provide for expansion and contraction.

- B. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.
- C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps.
- D. Wherever possible, structural attachments shall be beam clamps.
- E. All rigid hangers shall provide a means of vertical adjustment after erection.
- F. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.
- G. Where horizontal piping movements are greater than 1/2 inch, or where the hanger rod angularity from the vertical is greater than 4 degrees from the cold to hot position of the pipe, the hanger pipe and structural attachments shall be offset in such manner that the rod is vertical in the hot position.
- H. Hangers shall be designed so that they cannot become disengaged by movements of the supported pipe.
- I. Where supports are attached to concrete or other structural members, care shall be taken to prevent damage or weakening of the structural members.
- J. Hangers and supports that are in direct contact with copper piping shall be copper plated or have nonmetallic coating for electrolytic protection.

PART 3 - EXECUTION

3.1 INSTALLATION HORIZONTAL PIPE SUPPORT

- A. Steel and stainless-steel pipe shall be supported at a maximum span of 10 feet for all pipe sizes, with hanger rods sized accordingly for total supported weight.
- B. Copper pipe shall be supported at a maximum length of 6 feet for pipe sizes up through 1-1/2" and at a maximum length of 10 feet for pipe sizes 2" and larger with hanger rods sized accordingly for the total supported weight.
- C. Cast Iron soil pipe shall be supported with one hanger for each section of pipe (maximum 10' span) with hanger rods sized accordingly for the total supported weight. Locate hangers within 18" of hub or joint.
- D. In addition to the above specified spacings, install additional hangers at change in pipe direction and at concentrated loads, large valves, strainers, etc.
- E. When two or more pipes are to be run parallel together and are not exposed, they may be supported on trapeze type hangers. Trapeze bar angles or channels and hanger rods shall be of sufficient size with required spacing to support the particular group of pipes.

- F. For suspending hanger rods from brackets attached to walls; use welded steel brackets, Fig. 194 for loads up to 750 lbs; Fig. 195 for loads up to 1,500 lbs; Fig. 199 for loads up to 3000 lbs.
- G. Where pipes are to be racked along walls, use malleable iron one hole clamp, Fig. 126 for pipes up to 3". For pipes larger than 3", use steel channel strut pipe rack.
- H. Where pipes are to be supported from floor, use unistrut pipe stand with post base. Unformed concrete will not be permitted.
- I. Hangers and supports for insulated cold piping shall not injure or pierce insulation. Provide insulation protection shields or saddles for piping, (Fig. 167) in conjunction with hanger or roll device

3.2 PIPE ATTACHMENTS

- A. For horizontal steel pipe, use adjustable carbon steel clevis, Fig. 260, for pipes up to 30".
- B. For horizontal copper pipe and tube, use copper plated adjustable carbon steel clevis, Fig. CT 65.
- C. When thermal expansion for horizontal pipe is in excess of 1/2" axially as indicated on the drawing, use adjustable steel yoke pipe roll, Fig. 181, or pipe roll stand, Fig. 177.

3.3 INTERMEDIATE ATTACHMENTS

- A. Hanger rods: use carbon steel single or double end threaded, Figs. 140 and 253 as required. Continuous threaded rod, Fig. 146, may be used wherever possible. Contractor may at his option cut and thread rod on the job site.
- B. Chain, wire or perforated strap hangers will not be permitted. One pipe shall not be suspended from another pipe.
- C. Hangers shall be supported from appropriate structural members. In no case shall hangers be supported from ductwork, cable trays, piping, or other equipment. Existing hangers and supports shall not be used as supports for new hangers unless specifically designed as such, or additional loadings have been confirmed to be acceptable for existing supports.

3.4 STRUCTURAL ATTACHMENTS

- A. For attaching steel or copper plated hanger rods to reinforced concrete; use black carbon steel concrete inserts, Fig. 285 for loads up to 400 lbs., Fig. 281 for loads up to 1200 lbs. or suitable drilled inserts equal to Ramset/Red Head - Trubolt wedge anchor, Ramset/Red Head Epcon system or Hilti Kwik Bolt II anchor.

- B. For attaching steel hanger rods to structural steel beams, use malleable iron C clamps, Fig. 87, with retaining clip for loads up to 500 lbs.; Fig. 229 with extension piece for loads up to 1,365 lbs. For copper plated hanger rods, use copper plated malleable iron C clamps, Fig. CT 88, with hardened cup point set screw, for loads up to 400 lbs.
- C. Under no circumstances shall hangers be attached to metal roof deck.

3.5 PIPE COVERING PROTECTION

- A. Hangers and supports for insulated cold piping and ductwork shall not injure or pierce insulation. Provide insulation protection shields or saddles for piping, Fig. 160, 161, 162, 163, 164, 165, 165A, 166A, or 167 in conjunction with hanger or roll device.

3.6 ROOF MOUNTED PIPING AND EQUIPMENT

- A. Roof mounted equipment, not specified to be mounted on roof curbs, shall be installed on equipment mounting rails specifically designed for that purpose or as shown on plans.
- B. Roof mounted piping shall be mounted on a pipe support system equal to B-Line C-Port.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Identification shall be provided on all non-concealed plumbing piping and equipment as indicated by this section, on drawings and/or specified in other Division 22 sections.
- B. Type of identification devices specified in this section include the following:
 - 1. Plastic pipe markers
 - 2. Plastic tape
 - 3. Valve tags
- C. Identification furnished as part of factory fabricated equipment, is specified as part of the equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE

- A. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Pipe marker material, color, and nomenclature.
 - 2. Valve tag material, color, and nomenclature.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

B. Provide closeout items containing the following:

1. Schedules: Submit valve schedule for each piping system, formatted in an Excel spreadsheet with a digital copy provided to the Owner along with a printed copy on 8 1/2" x 11" paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut off and similar special uses, by special "flags", in margin of schedule. In addition, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than one single type is specified for an application, selection is Installer's option, but provide single selection for each product category.

B. Plastic Pipe Markers:

1. General: Provide manufacturer's standard pre-printed flexible or semi rigid, permanent, color coded, plastic sheet pipe markers.
2. Color: Color of pipe markers shall comply with ANSI A13.1.
3. Small Pipes: For external diameters not greater than 6" (including insulation if any), provide full band pipe markers extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap on application of pre tensioned semi rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 3/4" wide full circle at both ends of pipe marker, tape lapped 1 1/2".
4. Lettering: Manufacturer's standard preprinted nomenclature which best describes piping system in each instance, as selected by Design Professional in cases of variance with names as shown or specified.
5. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

C. Plastic Tape:

1. General: Manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
 - a. Width: Provide 1 1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2 1/2" wide tape for larger pipes.
 - b. Color: Comply with color selection indicated for Plastic Pipe Markers.

D. Valve Tags:

1. Brass Valve Tags: Provide polished brass valve tags with stamp engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 7/16" high, and with 3/16" hole for fastener. Tag thickness 0.040 inches.
 - a. Provide 2" diameter tags, except as otherwise indicated.
 - b. Fill tag engraving with black enamel.
2. Plastic Valve Tags: Provide red heavy plastic tag with 7/16" white embossed sequenced numbers.
3. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S hooks or heat sealed braided copper wire of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.2 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.
 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags, install identification after completion of covering and painting if any. Install identification prior to installation of acoustical ceilings and similar concealment.

B. Piping System Identification:

1. General: Install pipe markers of one of the following types on each piping system, and include arrows to show normal direction of flow:
 - a. Stenciled markers, including color coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
 - b. Plastic pipe markers, with application system as indicated under "Materials" in this section.
 - c. Stenciled markers, black or white for best contrast, wherever continuous color coded painting of piping is provided.

2. Locate pipe markers, color bands, and flow direction arrows at all installations of piping, including all exposed piping, piping above all ceilings (both accessible and inaccessible ceilings), and within view of any points of access (access doors, manholes, etc.). The only locations where pipe labels are not required are on piping concealed behind or within any inaccessible walls and within inaccessible chases or shafts. When installing markers, bands, and arrows, they shall be installed to meet the following provisions:
 - a. Visible from the floor.
 - b. Near each valve.
 - c. Near each branch, excluding short take offs for fixtures and equipment; mark each pipe at branch, where there could be question of flow pattern.
 - d. Near locations where pipes pass through walls or floors/ceilings, or enter non accessible enclosures.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced intermediately at maximum spacing of 20' along each piping run with a minimum of one marker in each room and on both sides of walls the pipe penetrates

C. Valve Identification:

1. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, valves that are 3/4" and adjacent to equipment served, plumbing fixture faucets, convenience and lawn watering hose bibs, and shut off valves at plumbing fixtures and similar rough in connections of end use fixtures and units. List each tagged valve in valve schedule and project number for each piping system.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary to install insulation to all hot and cold surfaces of piping, tanks, fittings and other surfaces as required by the drawings and this section.
- B. Insulation shall include insulating materials, jackets, adhesive, mastic coatings, tie wire and other materials as required to complete the insulating work.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Insulating materials, jackets, mastics, etc., shall meet flame spread and smoke developed ratings in accordance with NFPA-90A. Flame spread rating of not more than 25, smoke developed rating of not more than 50 as tested by ANSI/ASTM E84 (UL 723) (NFPA 255) method. All accessory items such as PVC jacketing and fittings, adhesive, mastic, cement tape and cloth shall have the same component ratings as specified above.
- B. Installation of insulation materials shall be in accordance to ASHRAE 90.1 and the latest edition of MICA/NIAC National Commercial & Industrial Standards for the appropriate material application.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's catalog cut sheets and schedules for each type of plumbing insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each plumbing system requiring insulation.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water, and chemical and plumbing damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Insulating Materials
 - 1. Owens/Corning Fiberglass Corp.
 - 2. Armacell
 - 3. Pittsburgh Corning Corp.
 - 4. CertainTeed Corp.
 - 5. Knauf Fiber Glass
 - 6. John's-Manville Corp.
 - 7. Aeroflex
- B. Mastics and adhesives as recommended by insulation manufacturer.

2.2 PIPE INSULATION

- A. Type 'A': Preformed sectional heavy density fiberglass insulation and factory applied vapor barrier, all service jacket with pressure sensitive self-sealing longitudinal laps and butt strips. Suitable for operating temperatures from 0 to +850 deg. F. Thermal conductivity shall be no more than 0.23 Btu-in/hr-sq.ft.-deg F @ 75 deg. F mean temperature. Water vapor permeance of .02 perms. Equal to Owens Corning 25 ASJ/SSL.
 - 1. Where insulation is exposed to weather outdoors it shall be covered with an aluminum or stainless steel weatherproof jacket 0.016" thick and sealed.
 - 2. Where insulation is exposed in indoor occupied space and within 8 feet of finished floor, it shall be covered with 30 mil PVC jacket equal to Johns Manville Zeston.
 - 3. Where insulation is exposed in a mechanical room and is within 6 feet of finished floor, it shall be covered with a 0.020" aluminum jacket.

- B. Type 'B': Flexible elastomeric extruded pipe covering, 6 pound density, 0.27 K factor, water vapor permeance of 0.20 perms. Suitable for temperature from -40 deg. F to +220 deg. F. Equal to Armacell, AP Armaflex, joints sealed with adhesive as recommended by insulation manufacturer.
 - 1. Where insulation is exposed to weather outdoors it shall be covered with an aluminum or stainless steel weatherproof jacket 0.016" thick and sealed.
 - 2. Where insulation is exposed in indoor occupied space and within 8 feet of finished floor, it shall be covered with 30 mil PVC jacket equal to Johns Manville Zeston.
 - 3. Where insulation is exposed in a mechanical room and is within 6 feet of finished floor, it shall be covered with a 0.020" aluminum jacket.

2.3 FITTING INSULATION

- A. Type 'A1': Fittings: Insulate with mitered segments of same insulating material as for adjacent pipe covering, or with pre-molded fiberglass wired in place and covered with all-service jacket or low smoke PVC fitting covers. Valve bodies, strainer bodies, flanges, etc.: insulate with single or multiple layers of same insulating material as for adjacent pipe covering, wired in place and covered with all-service jacket.
- B. Type 'B1': Fittings: Insulate fittings, valve bodies, strainer bodies, etc., with mitercut pipe insulation or sheet insulation of same material as pipe covering.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use only experienced applicators regularly engaged in the trade. Rough work will be rejected. Application details shall be in accordance with the insulating materials supplier's recommendations except where a higher standard is specified. All surface finishes shall be extended in such a manner as to protect all raw edges, cuts and surfaces of insulation.
- B. Do not insulate the following:
 - 1. Valve bonnets
 - 2. Unions in hot piping
- C. Inspect all piping and equipment before applying insulation to ensure the installing contractor has completed all leak tests, and that all surfaces are clean, dry and ready for application of insulation. Colder than ambient systems shall not be put into operation until insulation and vapor barriers are complete.
- D. Covering for "cold" pipes shall pass unbroken through hanger clevises, sleeves, walls, floor penetrations, etc. All details of covering for cold surfaces shall be such that continuous covering with unbroken vapor barrier and uncompressed insulation is provided as required to prevent condensation. The same covering and hanging detail shall be used for pipes connecting to vibrating equipment or carrying pulsating pressures to avoid metal contact between pipes and hangers.

- E. Insulation at removable heads, strainer plugs, and other access points shall be fabricated in such a manner that it can be readily removed without damage to the insulation. Removable insulation shall have a vapor proof cover fabricated so as to allow it to be resealed to the equipment vapor barrier.
- F. Provide rigid insulation inserts at hangers for pipes sizes 2" and larger. Inserts shall be polyisocyanurate or calcium silicate, a minimum of 180 degrees and extend 2" beyond the hanger shield. Refer to MICA Plate 1-610. Wood or plastic block hanger inserts shall not be used.
- G. Use hydraulic insulating cement anywhere insulation fibers are exposed, to fill voids, and to repair damages to the factory applied vapor barrier. Finish with material matching or compatible with adjacent jacket material.

*******NOTE: Not all services may apply – refer to plans for scope of services. *******

3.2 INSULATION SCHEDULE

Service	Type Insulation and Thickness*
Above Ground Piping	
Domestic cold water lines (including all pipe material types)	Type A and A1: All pipe sizes – 1" thick Type B and B1: Pipe sizes 1-1/4" and smaller – 1/2" thick Pipe sizes 1-1/2" and larger – 1" thick
Domestic hot water, tempered water, and recirculating lines (including all pipe material types)	Type A/B and A1/B1: Pipe sizes 1-1/4" and smaller – 1" thick Pipe size 1-1/2" – 1-1/2" thick Pipe sizes 2" and larger – 2" thick
Storm piping, sump pump discharge lines. Sanitary vent piping within ten feet of roof penetration	Type A and A1: 1" thick for all pipe sizes Type B and B1: 1" thick for all pipe sizes
* Insulation type and thickness indicated in table apply for all pipe materials. **For piping exposed to outdoor ambient temperatures, increase thickness by 1/2"	

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to fabricate and install complete piping system as required by the drawings and this section.
 - 1. Extent of domestic water piping work is indicated on drawings and schedules, and by requirements of this section.
 - 2. Insulation of domestic water piping is specified in other Division 22 sections and is included as work of this section.
 - 3. Installation of valves for domestic water piping system is specified in other Division-22 sections and is included as work of this section.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Fabricate and install domestic water piping in accordance with ASME B31.9 "Building Services Piping".
- B. UPC Compliance: Fabricate and install domestic water piping in accordance with IAPMO "Uniform Plumbing Code".
- C. Plumbing and Drainage Institute: Fabricate and install domestic water piping with Standard PDI-WH201.
- D. ANSI/NSF 372 Certification: All potable water supply piping, valves, fittings, and fixtures (excluding toilets, urinals, fill valves, flush valves, shower valves, and main gate valves greater than 2") shall meet the requirements for ANSI/NSF 372 Certification, Drinking Water System Components, Lead Content.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's material data and installation methods for each type of piping to be provided.

2. Manufacturer's catalog cut sheets for each type of device to be used.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.
 2. Startup and test reports.
 3. Manufacturer's Warranty: Submit manufacturers standard warranty document.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Water Hammer Arrestors
 1. Ancon
 2. Sioux Chief
 3. Wade
 4. Watts
 5. Zurn
- B. Copper Pressure Seal Fittings
 1. Viega Pro Press
 2. NIBCO Press System

2.2 BASIC MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Uniform Plumbing Code and International Plumbing Code where applicable, base pressure rating on domestic water piping system's maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.
- B. Valves: Refer to Section 220523 - General Duty Valves for Plumbing Piping.
- C. Piping Specialties: Refer to Section - 220500 - Common Work Results for Plumbing.

- D. Supports, Anchors and Seals: Refer to Section 220529 - Hangers and Supports for Plumbing Piping.

2.3 PIPE:

- A. Provide pipe materials meeting the following criteria and referenced standards:
1. Type K Copper (K Cu): Type K copper water tube, hard temper, ASTM B88.
 2. Type L Copper (L Cu): Type L copper water tube, hard temper, ASTM B88.
 3. Brass (Brass): Schedule 40 Chromium plated, ASTM B43.
 4. Stainless Steel (St St): Type 304 schedule 10, ASTM A 312/ A 312M.
- B. Unless specifically prohibited by local codes, provide piping materials for systems indicated according to the following table:

Service	Material					
	PVC	K Cu	L Cu	Brass	PEX	St St
Domestic water below slab		X				
Water service pipes 2" and smaller	X	X				
Above ground domestic water			X		X	X
Exposed fixture connections				X		

2.4 FITTINGS:

- A. Copper water tube cast bronze or wrought copper:
1. Solder joint type. ASME B16.18 and B16.22-63. Where copper piping is used for combined water/fire protection water service, joints upstream of fire protection backflow preventer shall be brazed.
 2. Pressure Seal pipe joining system, copper press fittings, 1/2" to 4" in diameter. ASME B16.18, ASME B16.22. O-rings for copper press fittings shall be EPDM. Installation per manufacturer's recommendations.
- B. Brass pipe: Cast bronze screwed, 125-pound, flat band water pattern, chromium plated, for chromium plated pipe.
- C. Stainless Steel pipe:
1. Grooved-end (roll grooved only): ASTM A 815/A 815M. Stainless steel casting with dimensions matching stainless steel pipe.
 2. Pressure Seal piping joining system, Type 304 stainless steel, ASTM A312 Schedule 10S, with EPDM gasket UL Classified in accordance with ANSI/NSF 61.

2.5 JOINTS

A. Copper water tube:

1. Use non-corrosive 95-5 tin-antimony solder, cut pipe square, clean, ream and polish tube ends and inner surfaces of fittings, apply flux and solder joint as recommended by manufacturer of solder type fittings. Where copper piping is used for combined water/fire protection water service, joints upstream of fire protection backflow preventer shall be brazed.
2. Pressure Seal pipe joining system, copper press fittings, 1/2" to 4" in diameter. ASME B16.18, ASME B16.22. O-rings for copper press fittings shall be EPDM.

B. Stainless Steel pipe:

1. Grooved-end (roll grooved only): AWWA C606 for stainless steel pipe dimensions, stainless steel housing, bolts, and nuts, EPDM rubber gaskets suitable for hot and cold water.
2. Pressure Seal piping joining system, Type 304 stainless steel, ASTM A312 Schedule 10S, with EPDM gasket UL Classified in accordance with ANSI/NSF 61.

2.6 NIPPLES AND UNIONS

- A. All nipples shall conform to size, weight and strength of adjoining pipe. When length of unthreaded portion of nipple is less than 1-1/2", use extra strong nipple; do not use close nipples.
- B. For pipe 2" and smaller, use screwed unions, for pipe 2-1/2" and over use flanged unions connections.
- C. Install unions in the following locations so that a minimum amount of pipe need be disassembled:
1. Long runs, at intervals of 80 feet.
 2. In by-pass around equipment, valves, and controls.
 3. In connections to equipment.
 4. Where indicated on drawings.
- D. Dielectric unions shall be installed between any connection of copper pipe and ferrous piping or equipment. In grooved piping systems, provide Clearflo by Victaulic.

2.7 AIR VENTS

- A. Manual Air Vents: Bell & Gossett Model No. 17SR.
- B. Automatic Air Vents: Bell & Gossett Model No. 7

2.8 WATER HAMMER ARRESTORS

- A. Water hammer arrestors shall be piston type with seamless copper chamber, two O-ring piston and a 60 psi charge. Water hammer arrestors shall be sized, tested and certified in accordance with the Plumbing and Drainage Institute Standard PDI-WH201 and American Society of Sanitary Engineering Standard ASSE-1010.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which domestic water piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF BASIC MATERIALS AND PRODUCTS

- A. General: Install basic materials and products as per manufacturers' recommendations, Uniform and International Plumbing Codes, local code requirements and as required to meet system pressure and performance requirements.
- B. Piping Protection: Protect piping from damage during construction, including, but not limited to covering pipes during application of spray on fire-proofing to prevent fire proofing material from coming in contact with the pipes.
- C. Valves
 - 1. Refer to Section 220523 - General Duty Valves for Plumbing Piping.
 - 2. Locate valves for easy access and operation. Do not locate valves with stems below horizontal.
 - 3. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures and elsewhere as indicated.
 - 4. Shutoff Valves: Install on inlet and outlet of each domestic water equipment item and elsewhere as indicated.
- D. Piping Specialties: Refer to Section 220500 - Common Work Results for Plumbing.
- E. Supports and Anchors: Refer to Section 220529 – Hangers and Supports for Plumbing Piping and Equipment.

3.3 DOMESTIC WATER PIPING

- A. Install pipe for all domestic water and domestic water systems as indicated on drawings, as called for in other sections, and as specified herein.

- B. Arrange and install piping approximately as indicated; straight, plumb, and as direct as possible; form right angles on parallel lines with building walls. Keep pipes close to walls and avoid interference with other trades. Locate groups of pipes parallel to each other; space at a distance to permit applying full insulation and to permit access for servicing valves. Most piping to be run in concealed locations unless indicated exposed, or in equipment rooms. Locate piping to avoid ductwork.
- C. Install horizontal piping as high as possible without sags or humps so that proper grades can be maintained for drainage.
- D. Check all piping for interference with other trades; avoid placing water pipes over electrical equipment.
- E. Where rough-in is required for equipment furnished by others, verify exact rough-in dimension with owner or equipment supplier before roughing-in.
- F. Extend cold water and hot water piping to each fixture and other equipment requiring water supplies.
- G. Pitch pipes to accessible drainage point where unions, plugged tees or drainage valves shall be provided.
- H. Branch take off pipe connections shall come off the top of mains.
- I. Pipes built into masonry or concrete construction shall be wrapped with tar paper or burlap to prevent bonding to the concrete.
- J. No pipe shall be located in an outside wall or other location where freezing is likely to occur.
- K. No pipe shall be in contact with, or attached to, a structural member in a manner that causes the transmission of noise to the structure. Block ends of runs to prevent movement due to water hammer.

3.4 INSTALLATION OF FIXTURES

- A. Refer to Section 224000 - Plumbing Fixtures,
- B. General: Connect water piping system to plumbing fixtures as indicated and comply with manufacturer's instructions where not otherwise indicated.
- C. Refer Water supply to all fixtures and containers shall be so installed as to prevent back siphonage of polluted water into the water supply. All supplies shall be either above the flood rim of the fixture or separated from the drainage end by means of approved vacuum breakers

3.5 INSTALLATION OF WATER HAMMER ARRESTORS

- A. Install water hammer arrestors as indicated on the drawings and as required per Plumbing and Drainage Institute Standard PDI-WH201. Water hammer arrestors to be installed in accessible locations where possible.

3.6 INSTALLATION OF PLUMBING SPECIALTIES

- A. General: Install plumbing specialties and valves as per manufacturer's installation instructions.
- B. Provide unions, valves to units at each connection as required by inspection.

3.7 HYDROSTATIC TESTING

- A. General: New water mains shall be subject to hydrostatic testing in accordance with AWWA C600 and other applicable AWWA Standards of latest revision and the following supplemental instructions.
- B. Supplemental Instructions:
 1. All newly laid pipe or any valved section thereof shall be subject to a hydrostatic pressure of 1.5 X the working pressure at the point of testing or 100 psig, whichever is greater.
 2. The test procedures shall:
 - a. Not exceed pipe or thrust restraint design pressures.
 - b. Be of at least 4-hour duration.
 - c. Not exceed the rated pressure of the valves or hydrants.
 3. Each valved section of pipe shall be filled with water slowly and the specified test pressure shall be applied by means of a pump connected to the pipe.
 4. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants.
 5. Any damaged or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated.
 6. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain test pressure.
 7. No pipe installation will be accepted where leakage is observed.

3.8 TESTS AND DEMONSTRATIONS

- A. Tests Required: Piping shall be tested and proved tight under the following static pressures. Pressure shall be maintained for four (4) hours.

<u>System</u>	<u>Pressure</u>
Domestic Water Piping Systems	Refer to Section 221116 – Domestic Water Piping: Hydrostatic Testing

- B. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner. Provide notification seven days prior to testing. Contractor shall submit a report to Design Professional citing dates, times, pressures, and results of all tests performed.

3.9 DISINFECTION

- A. General: Upon completion of a newly installed piping or when repairs to an existing pipe are made, the piping shall be disinfected according to instructions listed in AWWA C651, local codes, local utility requirements, and the following supplemental instructions.
- B. Repairs: Repairs to mains and plumbing shall be disinfected by swabbing with hypochlorite and flushing in accordance with AWWA C651.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to fabricate and install complete piping system as required by the drawings and this section.
 - 1. Extent of sanitary waste and vent piping work is indicated on drawings and schedules, and by requirements of this section.

1.3 QUALITY ASSURANCE

- A. UPC Compliance: Fabricate and install sanitary waste and vent piping in accordance with IAMPO "Uniform Plumbing Code".
- B. Plumbing and Drainage Institute: Fabricate and install domestic water piping with Standard PDI-WH201.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's catalog cut sheets including materials and components and construction materials and dimension drawings for each type of drain.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.

2. Startup and test reports.
3. Manufacturer's Warranty: Submit manufacturers standard warranty document.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Floor Drains and Floor Sinks

1. Jay R. Smith
2. Jonespec
3. Josam
4. Wade
5. Watts
6. Zurn
7. Mifab

2.2 BASIC MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with International and Uniform Plumbing Codes. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in sanitary waste and vent piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.
- B. Piping Specialties: Refer to Section - 220500 - Common Work Results for Plumbing.
- C. Supports, Anchors and Seals: Refer to Section 220529 - Hangers and Supports for Plumbing Piping.

2.3 PIPE:

- A. Provide pipe materials meeting the following criteria and referenced standards:
 1. Cast Iron Soil Pipe (C-Iron): Service class, bell and spigot, asphalt coated, ASTM A74.
 2. No-Hub Cast Iron Soil Pipe (C-Iron NH): Service class, no hub, asphalt coated, CISPI 301 or ASTM A-888.
 3. DWV Copper (DWV Cu): Drainage Waste and Vent copper pipe , ASTM B306.
 4. Brass (Brass): 17 gauge brass tube, chromium plated, ASTM B43.

- B. Unless specifically prohibited by local codes, provide piping materials for systems indicated according to the following table:

Service	Material			
	C- Iron	C- Iron NH	DWV Cu	Brass
Sanitary waste and vent below slab to 5' outside building perimeter	X	X		
Sanitary waste and vent above slab, up to and including 2-1/2"		X	X	
Exposed fixture connections				X

2.4 FITTINGS:

- A. Material and strength of fittings for sewer pipe, conform to pipe as per ASTM Standards.
- B. Copper drainage tube: Cast bronze fittings, solder joint fittings. ANSI B16.23.
- C. Brass pipe: Cast bronze screwed, 125 pound, flat band water pattern, chromium plated, for chromium plated pipe.

2.5 JOINTS

- A. Cast iron bell and spigot soil pipe: Pack joints with oakum, fill with molten lead at one pouring, caulk solid flush with hub rim. If approved by Code, pre-set plastic or neoprene joint may be used, ASTM C 564.
- B. Cast iron no-hub pipe: Coupling assembly tightened by torque wrench, CISPI 310, ASTM C 564.
- C. Copper drainage tube: Use non-corrosive 50-50 solder, cut pipe square, clean, ream and polish tube ends and inner surface of fittings, apply flux and solder joint as recommended by manufacturer of solder type fittings. Use same method for copper refrigerant pipe, except use silver solder with 5% silver content, or equal strength brazing alloy.

2.6 VENTS

- A. Vents through the roof shall be cast iron long increasers beginning at 12" under the roof and extending at least above the highest possible water level on the roof but in no case less than 12". Size increases as follows:

Vent Size	Increase To
1-1/4" and 1-1/2"	3" minimum
2" and 2-1/2"	4" minimum
3"	4"
4"	6"

- B. Provide and install flashing for each vent through the roof. The flashing shall extend up around the pipe and be sealed to the pipe and shall extend over the roof deck at least one foot in each direction from the base.

2.7 FLOOR DRAINS AND FLOOR SINKS

- A. Shall be of the style as called for in fixture schedule.
- B. Drains without integral traps shall have service class p-traps.

2.8 CLEANOUTS

- A. In floors of finished areas: cast iron caulking ferrule for soil pipe hub with brass countersunk plug and cast brass round flush access cover with polished top.
- B. In floors of unfinished areas: cast iron with tapered body for caulking into soil pipe hub, with brass countersunk plug.
- C. In walls of finished areas: cast brass raised head plug and round stainless steel cover plate with polished top and countersunk cover screw. Provide with caulking ferrule where installed in cast iron soil pipe.
- D. In walls of unfinished areas: cast brass raised head, iron pipe size male threads. Provide with caulking ferrule where installed in iron soil pipe.
- E. In floors of areas subject to vehicular travel: cast iron with tapered body for caulking into soil pipe hub, with brass countersunk plug. Weight rated for fork truck and heavy traffic duty.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which sanitary waste and vent piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF BASIC MATERIALS AND PRODUCTS

- A. General: Install basic materials and products as required per manufacturer=s recommendations, International and Uniform Plumbing Codes, local code requirements and as required to meet the intent of the documents.
- B. No soil or waste pipe shall be covered by earth or construction without first being proved free of leaks by a hydrostatic test of at least 10 feet head.

- C. Install vents in practical alignment and supported with constant pitch back to the drainage system, concealed from finished spaces, unless shown or directed otherwise.
- D. Soil, waste and vent connections to fixtures shall be accurately located and concealed from finished spaces, unless indicated otherwise.
- E. Connections to horizontal branches shall be at 45 deg. angle using Wye or Tee-Wye. Connection to vertical stacks shall be with Sanitary Wye or Tee-Wye at 45 deg.

3.3 SANITARY WASTE AND VENT PIPING

- A. Install pipe for all sanitary waste and vent systems as indicated on drawings, as called for in other sections, and as specified herein.
- B. Arrange and install piping approximately as indicated; straight, plumb, and as direct as possible; form right angles on parallel lines with building walls. Keep pipes close to walls and avoid interference with other trades. Locate groups of pipes parallel to each other; space at a distance to permit applying full insulation and to permit access for servicing valves. Most piping to be run in concealed locations unless indicated exposed, or in equipment rooms. Locate piping to avoid ductwork.
- C. Provide proper support to maintain uniform fall of 1/4" per foot for lines 3" and smaller and 1/8" per foot for lines 4" and larger. Protect all openings against the entrance of dirt. Where piping must cross footings, the piping shall cross under footings unless noted otherwise on the drawings.
- D. Check all piping for interference with other trades, avoid placing water pipes over electrical equipment.
- E. Where rough-in is required for equipment furnished by others, verify exact rough-in dimension with owner or equipment supplier before roughing-in.
- F. Piping Specialties: Refer to Section 220500 - Common Work Results for Plumbing.
- G. Supports, Anchors and Seals: Refer to Section 220529 - Hangers and Supports for Plumbing Piping.
- H. Field Quality Control
 - 1. Piping Tests: Test sanitary waste and vent piping in accordance with testing requirements of Division 22 Basic Materials and Methods, Section 220010 - Plumbing General Provisions.

3.4 INSTALLATION OF CLEANOUTS

- A. Provide a cleanout at the base of each stack where the sewer leaves the building and at other points where required by code and good practice. Cleanout spacing shall not exceed 50'-0" on long runs. Cleanouts shall be the same size as pipe up to and including 6" and 6" for 6" or larger pipes. Cleanouts for concealed pipes shall be set flush with floor and wall surfaces.

3.5 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

- A. Obtain exact finished floor levels from the General Contractor and set floor drain top rims accurately to proper level below finished floor to allow for proper slope towards drains.

3.6 INSTALLATION OF FIXTURES

- A. Refer to Section 224000 - Plumbing Fixtures,

3.7 TESTS AND DEMONSTRATIONS

- A. Tests Required: Piping shall be tested and proved tight under the following static pressures. Pressure shall be maintained for four (4) hours.

<u>System</u>	<u>Pressure</u>
Sanitary Waste and Vent Piping Below Grade	10 feet waterhead or fill to top of vent outlet above roof.
Sanitary Waste and Vent Piping Above Grade	Fill piping with water to top of vent outlet above roof, or 10 feet waterhead.

TESTING NOTE: All rubber gasket joints for cast iron soil pipe and fittings should be properly restrained if test pressures exceed 10 feet of head.

- B. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner. Provide notification seven days prior to testing. Contractor shall submit a report to Design Professional citing dates, times, pressures, and results of all tests performed.

END OF SECTION 221316

SECTION 221516 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to fabricate and install complete piping system as required by the drawings and this section.
 - 1. Extent of natural gas piping work is indicated on drawings and schedules, and by requirements of this section.
 - 2. Installation of valves for natural gas piping system is specified in other Division-22 sections and is included as work of this section.
- B. Trenching and Backfill: Trenching and backfill required in conjunction with gas service piping is specified in applicable Division 22 sections and is included as work of this section.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and install natural gas systems in accordance with NFPA 54 "National Fuel Gas Code".
- B. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.
- C. UPC Compliance: Fabricate and install natural gas systems in accordance with IAPMO "Uniform Plumbing Code".

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's catalog cut sheets and schedules for all materials and components.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.
 - 2. Startup and test reports.
 - 3. Manufacturer's Warranty: Submit manufacturers standard warranty document.
 - 4. Spare Parts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pressure Regulators:

- 1. Cashco
- 2. Fisher
- 3. Maxitrol

B. Plug Valves

- 1. Homestead
- 2. Nordstrum
- 3. Walworth
- 4. DeZurik

C. Ball Valves

- 1. Watts
- 2. Nibco
- 3. Apollo
- 4. Milwaukee

2.2 BASIC MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable; base pressure rating on natural gas piping system's maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in natural gas piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

- B. Piping Specialties: Refer to Section - 220500 - Common Work Results for Plumbing.
- C. Supports, Anchors and Seals: Refer to Section 220529 - Hangers and Supports for Plumbing Piping.

2.3 PIPE:

<u>Material</u>		<u>Service</u>
A.	Painted Black steel pipe Schedule 40, ASTM A53	Exterior natural gas piping.

2.4 FITTINGS:

- A. Steel Pipe:
 - 1. Threaded pipe (2" dia and smaller): Malleable iron fittings, 125 pound standard flat band water pattern.
 - 2. Welded pipe (2 1/2" dia and larger): Standard radius weld fittings and weld neck or slip-on flanges, same material and strength as pipe.

2.5 JOINTS

- A. Steel Pipe:
 - 1. Threaded pipe (2" dia and smaller): Make joints using Teflon tape applied to male threads only. Cut pipe square, cut threads clean, remove burrs and ream ends to full size of bore. For fuel piping and lubricating oil piping, joint sealing material shall be resistant to petroleum products.
 - 2. Welded pipe (2 1/2" dia and larger): Welding shall conform to welding section of ANSI-B31.3 "Code for Power Piping."

2.6 NIPPLES AND UNIONS

- A. All nipples shall conform to size, weight and strength of adjoining pipe. When length of unthreaded portion of nipple is less than 1-1/2", use extra strong nipple; do not use close nipples.
- B. For pipe 2" and smaller, use screwed unions, for pipe 2-1/2" and over use flanged unions. For steel pipe use black or galvanized malleable iron unions, to conform to pipe with ground joint. Cast iron flanged unions gasket type. For threaded brass pipe, use bronze ground joint unions with octagon ends.
- C. Install unions in the following locations so that a minimum amount of pipe need be disassembled:
 - 1. In by-pass around equipment, valves, and controls.
 - 2. In connections to equipment.
 - 3. Where indicated on drawings.

2.7 VALVES

- A. Natural Gas: 2" and smaller: Two-piece full-port bronze ball valve, suitable for natural gas service, threaded ends.
- B. Natural Gas: 2 1/2" to 6": Carbon steel or cast iron plug valve MSS SP-78, WOG (suitable for natural gas service) with flanged ends.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which natural gas piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF BASIC MATERIALS AND PRODUCTS

- A. General: Install basic materials and products as per manufacturer=s recommendations, Uniform Plumbing Code, local code requirements, Utility Company requirements and as required to meet the intent of the document.
- B. Natural Gas Piping
 - 1. Install pipe for all natural gas systems as indicated on drawings, as called for in other sections, and as specified herein.
 - 2. Arrange and install piping approximately as indicated; straight, plumb, and as direct as possible; form right angles on parallel lines with building walls. Keep pipes close to walls and avoid interference with other natural gas items. Locate groups of pipes parallel to each other; space at a distance to permit applying full insulation and to permit access for servicing valves. Most piping to be run in concealed locations unless indicated exposed, or in equipment rooms. Locate piping to avoid ductwork.
 - 3. Install horizontal piping as high as possible without sags or humps so that proper grades can be maintained for drainage.
 - 4. Check all piping for interference with other trades; avoid placing pipes over electrical equipment.
 - 5. Where rough-in is required for equipment furnished by others, verify exact rough-in dimension with owner or equipment supplier before roughing-in.
 - 6. Piping up to 2" diameter shall be screwed, piping 2-1/2" diameter and over shall be welded. Concealed gas piping shall be welded or otherwise installed as required per NFPA 54 and local code.
 - 7. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.
 - 8. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.
 - 9. Install piping with 1/64" per foot (1/8%) downward slope in direction of flow.

10. Exposed outside pipe: Prime coat with appropriate lead oxide paint and apply finish enamel coat to match color of adjacent building material.

C. Valves

1. Locate valves for easy access and operation. Do not locate valves with stems below horizontal.
2. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more natural gas terminals or equipment connections, and elsewhere as indicated.
3. Shutoff Valves: Install on inlet and outlet of each natural gas equipment item, and on inlet of each natural gas terminal, and elsewhere as indicated.
4. Drain Valves: Install on each natural gas equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain natural gas piping system.

D. Piping Specialties: Refer to Section 220500 - Common Work Results for Plumbing.

E. Supports, Anchors and Seals: Refer to Section 220529 - Hangers and Supports for Plumbing Piping.

F. Install specialties and accessories as indicated on drawings and in accordance with manufacturer's recommendations and applicable codes and standards.

3.3 INSTALLATION OF EQUIPMENT CONNECTIONS

- A. General: Connect gas piping to each gas fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

- A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and local utility company requirements.

3.5 TESTS AND DEMONSTRATIONS

- A. Tests Required: Piping shall be tested and proved tight under the following static pressures. Pressure shall be maintained for four (4) hours.

System	Pressure
Natural Gas Piping	10 psi air pressure, liquid soap test around all joints.

- B. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner. Provide notification seven days prior to testing. Contractor shall submit a report to Design Professional citing dates, times, pressures, and results of all tests performed.

3.6 ADJUSTING AND CLEANING

- A. Cleaning and Inspecting: Clean and inspect natural gas systems in accordance with requirements of Division 22 Basic Mechanical Materials and Methods, Section 220010 – Plumbing General Provisions.

3.7 SPARE PARTS

- A. Valve Wrenches: Furnish to Owner, with receipt, 2 valve wrenches for each type of gas valve installed, requiring same.

END OF SECTION 221516

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 220010 - Plumbing General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary for the plumbing fixture installation as required by the drawings and this section.
- B. Fixtures, trim and accessories shall be of type and model numbers as scheduled on the drawings.

1.3 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data – provide one submittal containing the following information:
 - 1. Manufacturer's catalog cuts giving manufacturer's model numbers, fixture and rough in dimensions, and construction material for each type of fixture, trim and accessory scheduled.
 - 2. Furnish rough-in information that impacts other trades to General Contractor for distribution to other sub-contractors. This includes, but is not limited to, sink cut out templates, shower/tub framing dimension drawings, electrical power rough-in dimension drawings, etc.

1.4 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

1.5 QUALITY ASSURANCE

- A. ANSI/NSF 372 Certification: All potable water supply piping and valves shall meet the requirements of ANSI/NSF 372 Certification, Drinking Water System Components, Lead Content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to schedules on plans for basis of design plumbing fixtures. All other manufacturers must submit a substitution request for approval prior to bidding.
- B. Vitreous China and Cast Iron Enameled Fixtures
 - 1. American Standard
 - 2. Kohler
 - 3. Zurn
 - 4. Sloan
- C. Stainless Steel Sinks
 - 1. Elkay
 - 2. Just
 - 3. Kohler
 - 4. Franke
 - 5. Acorn Engineering
- D. Faucets
 - 1. American Standard
 - 2. Chicago Faucet
 - 3. Delta
 - 4. Elkay
 - 5. Kohler
 - 6. T & S Brass Works
 - 7. Sloan
 - 8. Zurn
- E. Flush Valves
 - 1. Sloan - Royal Series
 - 2. Zurn – Aquavantage Series
- F. Carriers
 - 1. Jay R. Smith
 - 2. Josam
 - 3. Wade
 - 4. Watts

5. Zurn

G. Valve Boxes

1. Guy Gray

2.2 VITREOUS AND CAST IRON FIXTURES

- A. Vitreous ware shall be non absorbant, even color, unwarped, two fired vitreous china, grade "A" as rated by the Bureau of Standards.
- B. Enameled cast iron fixtures shall have the enamel fused with the iron to provide a hard acid resisting enameled finish.
- C. Vitreous and enamel fixtures shall be white, except where other colors are called for in the schedule.

2.3 STAINLESS STEEL SINKS

- A. Stainless steel sinks shall be fabricated from 18 gauge nickel bearing type 302 stainless steel, with satin finish, sound deadening treatment and 3/16" drop down ledge. Provide with channel and pull down clips to ensure tight seal between sink and countertop.

2.4 ACCESSORIES

- A. Accessories to include supply pipes, stop valves, faucets, tail pieces, strainers, waste and traps. Floor and wall plates shall be brass. Exposed accessories shall be chrome plated.
- B. Potable water supply piping, faucets and fixtures and associated accessories (excluding toilets, urinals, fill valves, flush valves, and shower valves) shall meet the certification requirements of ANSI/NSF 372 – Drinking Water System Components, Lead Content.
- C. Stop valves shall be compression type with loose key control.
- D. P-trap shall be adjustable 18 gauge tubular brass. Where offset P-traps are required for handicapped accessible lavatories, offset and P-trap shall be insulated with Handi Lav-Guard by Truebro, or equal. When supply risers are exposed, they shall be insulated with Handi Lav-Guard by Truebro, or equal.
- E. Accessories shall be considered "exposed" even when concealed behind base cabinets having doors.
- F. Mixing valve, transformer, or piping under the counter shall be covered with Lav-Shield by Truebro or equal in areas where a cabinet does not cover them.
- G. Water fixture carriers:
 - 1. Coordinate orientation and outlet location requirements with field piping layout.

2. Provide coupling/nipple length as required by wall thickness at each location.
3. Fixture carriers shall be heavy duty type with a minimum weight rating of 500 lbs.

2.5 VALVE BOXES

- A. Box material shall be PVC High temperature Resin with Intumescent pad for to achieve fire rating required to match rating of wall where box is shown on plans. Snap on frame shall accommodate up to two layers of 5/8" drywall.
- B. Valves shall be included as indicated in Plumbing Fixture Schedule on the plans. All valves for domestic hot or cold water shall be lead free and comply with NSF/ANSI 372 (annex G) and the US Safe Drinking Water Act.
- C. Accessories: Provide other accessories as indicated in the Plumbing Fixture Schedule on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fixtures and make water supply, waste and vent connections as indicated on the drawings.
- B. Set fixtures in center of stalls, between partitions where required. Dimensions for spacing shall be verified with General Contractor. Fixtures in ADA accessible stalls shall be installed with the flush valve handle to the open side of the stall, where applicable.
- C. Setting shall be absolutely tight and rigid on proper ground. Use Miracle Adhesive Corporation Tub Caulk or approved equal pointing material under all setting surfaces.
- D. Wall hung fixtures shall be securely hung. All wall hung fixtures shall have carriers unless other mounting means are approved by Design Professional. Mounting heights shall be as indicated on Architectural elevations, and in accordance with the requirements of the ADA.
- E. Chair carriers shall be securely braced to construction and shall be concealed with feet concealed in floor. Where feet cannot be concealed in floor, provide stub feet. Carriers for urinals shall have thrust bolts at bottom. Carriers for lavatories and electric water coolers shall have mounting plate type hanger or concealed arms as required by the fixture schedule. Carriers shall be coordinated with plumbing fixtures.
- F. Fixtures shall be covered after they are set to prevent damage during the balance of construction. At the conclusion of work, the covering shall be removed and the fixtures properly cleaned.
- G. Contractor shall be responsible for the protection of the fixtures until acceptance by Owner. Damaged fixtures shall be replaced at no additional cost to Owner.

- H. Joints of lavatories with counter and/or wall, sinks with wall, urinals with wall and water closets with wall and/or floor shall be caulked with transparent silicone caulk by Contractor.

END OF SECTION 22 4000

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SECTION 230010 - HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Refer to Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. This section applies to all work under the HVAC contract. This shall include, but not necessarily be limited to, the following:
 - 1. Ductwork for Air Distribution
 - 2. Grilles, Registers, Diffusers and Dampers
 - 3. Thermostats and Control Wiring
 - 4. Insulation of Ducts and Plenums
 - 5. Rooftop Unit Air Conditioners
- B. The work shall include all materials, equipment and labor required for complete and properly functioning HVAC systems.
- C. Drawings for HVAC work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping and approximate sizes and locations of equipment and materials.
- D. Where job conditions require reasonable changes in indicated locations and arrangements, make such changes without additional cost to Owner.
- E. Because of the scale of the drawings, certain piping or items such as unions or fittings may not be shown, but where such items are required by other sections of the specifications, or where they are required by the nature of the work, they shall be furnished and installed.
- F. All elements of the construction shall be performed by workers skilled in the particular craft involved, and regularly employed in that particular craft.
- G. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. International Fire Suppression Code
 - 2. Uniform Plumbing Code

3. Iowa State Plumbing Code
4. International Mechanical Code
5. Iowa State Mechanical Code
6. International Building Code
7. National Electric Code (NEC)
8. National Fire Protection Association Standards (NFPA)
9. Local Utility Company Requirements
10. Local Codes, all trades
11. Standards of ASME, ASHRAE, NEMA, IEEE, AGA, SMACNA
12. Occupational Safety and Health Administration (OSHA)
13. Underwriters Laboratories, Inc. (U.L.)
14. Iowa Administrative Codes
15. Americans With Disabilities Act (ADA)

- B. Contractors shall familiarize themselves with all codes and standards applicable to their work and shall notify Design Professional of any discrepancies between the design and applicable code requirements so that any conflicts can be resolved. Where two or more codes or standards are in conflict, that requiring the highest order of workmanship shall take precedence, but such questions shall be referred to Design Professional for final decision.
- C. Where drawings or specifications call for workmanship or materials in excess of code requirements, a lower grade of construction will not be permitted.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Secure all required permits and pay for all inspections, licenses and fees required in connection with the HVAC work. Contractor shall post all bonds and obtain all licenses required by the State, City, County and Utility.

1.5 HVAC DRAWINGS

- A. The HVAC drawings indicate in general the building arrangement only, Contractor shall examine construction drawings to familiarize himself with the specific type of building construction, i.e. type of structural system, floors, walls, ceilings, room finishes and elevations.
- B. Drawings are intended to convey the scope of the work and to indicate the general arrangement and locations of ducts, piping and equipment.
- C. Contractor shall layout his own work and shall be responsible for determining the exact locations for equipment and rough-ins and the exact routing of piping and ducts so as to best fit the layout of the work.
- D. Contractor shall take his own field measurements for verifying locations and dimensions: scaling of the drawings will not be sufficient for laying out the work.

- E. Because of the scale of the drawings, certain basic items such as pipe fittings and valves may not be shown, but where such items are required by code or by other sections of the specifications, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact location of all existing services prior to beginning work in that area.
- B. Existing active services, i.e., water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain.
- C. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- D. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to familiarize himself with the conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate his work with the schedule of the General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of his work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to his equipment, other equipment and the building. Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.

- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications or between the requirements set forth for the various contractors shall be called to the attention of Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by Design Professional and his decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting and plaster until the project is substantially completed. Damage from rust, paint and scratches shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the Painting Contractor, but this shall not relieve Contractor of the responsibility for checking to assure that adequate protection is being provided.
- F. Where the final installation or connection of equipment in the building requires Contractor to work in finished areas of the building, Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Contractor shall arrange with the General Contractor for patching and refinishing of such areas which may be damaged in this respect.

1.9 OPENINGS, CUTTING AND PATCHING

- A. Piping, sleeves and ducts passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and pipe, sleeve, and/or duct shall be sealed with UL listed intumescent fire barrier material equivalent to rating of wall/floor. Where piping, sleeves and ducts pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk.
- B. Existing Structure:
 - 1. Contractor shall provide cutting, lintels and patching, and patch painting in the existing structure, as required for the installation of their work, and shall furnish lintels and supports as required for openings.
 - 2. Cutting of structural support members will not be permitted without prior approval of the Design Professional. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings.
 - 3. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.10 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable U.S.A. manufacturer regularly engaged in the manufacture of the specified item. Where two or more units are required of the same item, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items, when required, shall be furnished as part of the equipment, whether or not specifically called for.

1.11 SUBMITTALS

- A. Contractor shall furnish, to Design Professional, complete sets of shop drawings and other submittal data. Contractor shall review and sign shop drawings before submittal. Refer to Division 01 specifications for additional requirements.
- B. Shop drawings shall be bound into sets and cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal or unbound submittals will be rejected.
- C. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- D. After award of contract, Contractor shall provide a completed submittal schedule including dates that the submittals will be to Design Professional for review.
- E. Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- F. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to Design Professional in bookmarked pdf and duplicate printed hard copy upon completion of the job. Refer to Division 01 specifications for additional information.

- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three ring hard-backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
HVAC SYSTEMS

(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME AND ADDRESS OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Use plastic tab indexes for sections of manual. Each section shall contain the following information for equipment furnished under this contract:

1. Equipment and system warranties and guarantees.
2. Installation instructions.
3. Operating instructions.
4. Maintenance instructions.
5. Spare parts identification and ordering list.
6. Local service organization, address, contract and phone number.
7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.
8. Reports of all tests and demonstrations including certificate of owner instruction, testing and balancing report, etc.

1.13 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the HVAC installation, Contractor shall provide to Owner, or their designated representatives, all comprehensive training on essential features and functions of all systems installed, and shall instruct Owner in the proper operation and maintenance of such systems.

1. Provide adequate notice to Owner as to when instruction will be conducted so appropriate personnel can be present.
2. Prepare the instruction format for a minimum of four Owner Representatives.

- B. System training for Owner:

1. HVAC and Temperature Controls Contractors shall jointly conduct system operating training. These sessions shall include:
 - a. HVAC system overview.
 - b. System wide start-up.

- c. Operation of control system.
 - d. Function of each component.
 - e. System operating procedures in all possible modes.
 - f. Programming procedures.
 - g. Shut-down and maintenance procedures.
 - h. Emergency procedures.
- C. System training shall include, but not be limited to, valve locations, system routing, and air/water flow patterns, system start-up/shut-down/emergency procedures.
- D. Contractor shall submit to Design Professional a certificate, signed by Owner stating the date, time and persons instructed and that the instruction has been completed to Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that Contractor has demonstrated the hereafter listed systems to Owner's representatives in accordance with the Contract documents and that the instruction has been completed to Owner's satisfaction.

- A. Project:
- B. System(s):
- C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

- D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

- E. Acknowledgement of demonstration:

Contractor's Representative:

signature

date

Owner's Representative:

signature

date

- A. Refer to Divisions 00 and 01.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.15 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer, model, type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plan schedules are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of Contractor and/or the manufacturer.
- C. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions (including accessibility for maintenance), operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
- D. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.16 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.

- b. The entire HVAC system, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 23 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.17 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by Owner.
- B. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

1.18 CLEANING

- A. Prior to assembly of pipe and piping components, all loose dirt, scale, oil, and other foreign matter on internal and exterior surfaces shall be removed by means consistent with good piping practices. During fabrication and assembly, slug and weld splatter shall be removed from both internal and external pipe joints by preening, chipping, and wire brushing.
- B. At the conclusion of the construction, the entire system of piping and equipment shall be cleaned internally. Prior to flushing erected piping surfaces, Contractor shall disconnect all instrumentation and equipment and open wide all valves.
- C. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. Name plates, ratings, instruction plates, etc., shall not be obscured by paint, insulation, or placement of units.
- D. Heating and air conditioning equipment shall be thoroughly cleaned and clean filters installed.

1.19 ELECTRICAL WORK

- A. Electrical work and equipment provided by HVAC Contractor shall include the following:
 - 1. Starters and disconnects for motors of HVAC equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 2. Wiring from motors to disconnect switches or junction boxes for motors of HVAC equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Electrical heating coils and similar elements in HVAC equipment.
 - 4. All control wiring in accordance with the requirements of Division 26.
- B. Electrical Contractor shall provide all power wiring for HVAC equipment, including services for motors and equipment furnished by the HVAC contractor. Motor and equipment locations are shown on the electrical drawings.
- C. Electrical Contractor shall make final connections for all motors and equipment furnished by the HVAC contractor.
- D. Electrical Contractor shall furnish safety disconnects and starters for all motors and equipment furnished by the HVAC contractor (unless specifically indicated to be furnished integrally with the equipment), so as to make service complete to each item of equipment.
- E. Contractor shall consult with Electrical Contractor prior to conduit rough-in and shall verify with him the exact locations for rough-ins, and the exact size and characteristics of the services required, and shall provide Electrical Contractor a schedule of electrical loads for the equipment furnished by him. These schedules will be used for sizing services, disconnects, fuses, starters and overload protection.
- F. Refer to Division 23 Controls section for control system wiring. Control wiring shall be done in accordance with the requirements of Division 26.

1.20 TEMPORARY UTILITIES

- A. Refer to Division 01 for specific requirements concerning temporary utilities.
- B. Under no circumstances shall the building HVAC equipment be used for temporary heat, cooling or ventilation during construction prior to Owner acceptance of the building at substantial completion.

END OF SECTION 23 0010

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SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the following:
 - 1. Demolition

PART 2 - PRODUCTS

2.1 DEMOLITION MATERIALS

- A. All materials removed shall be the property of the removing contractor and shall be removed from the site by him, unless otherwise specified.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. General:
 - 1. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.
 - 2. Contractor shall remove existing equipment and piping not necessary for additions or existing portions of building as indicated on drawings and/or specified herein. To include all abandoned equipment and piping back to point of origin. Demolition of equipment shall include removal associated concrete equipment pad and/or support steel.
 - 3. Contractor shall be responsible for the cutting and capping of all existing services before any work is commenced by the General Contractor.

- B. Work by Others: Unless specifically noted under other contracts, Contractor shall assume all required work shall be performed by him. In general, the following will be performed by others:
1. General Contractor will remove any floors, walls and ceilings, neatly patch, match, complete and finish all affected surfaces.
 2. Electrical Contractor will disconnect all electrical services and remove abandoned conduit back to point of origin.
- C. Existing Conditions:
1. If any piping serving existing fixtures or equipment which are to remain are disturbed by operations under this Contract, Contractor shall provide pipe and insulation required to reestablish continuity of such piping systems.
 2. Contractor shall arrange for General Contractor to repair, patch and paint all construction, with material necessary to match surrounding material, which is necessary due to removal of equipment and piping.
 3. Contractor shall furnish all required labor and material where required to extend new work to connect to similar work where new addition adjoins existing building and for extension of existing system. Connection shall be made in a suitable manner.
- D. Owner's Right of Salvage: The Owner may designate and have salvage rights to any material herein demolished by the Contractor.

END OF SECTION 230500

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Identification shall be provided for all HVAC piping, ductwork and equipment as indicated by this section, on drawings and/or specified in other Division 23 sections.
- B. Type of identification devices specified in this section include the following:
 - 1. Plastic pipe and duct markers
 - 2. Plastic tape
- C. Identification furnished as part of factory fabricated equipment, is specified as part of the equipment assembly in other Division 23 sections.

1.3 QUALITY ASSURANCE

- A. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Marker material, color, and nomenclature.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

B. Provide closeout items containing the following:

1. Schedules: Submit valve schedule for each piping system, formatted in an Excel spreadsheet with a digital copy provided to the Owner along with a printed copy on 8 1/2" x 11" paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut off and similar special uses, by special "flags", in margin of schedule. In addition, furnish extra copies for Maintenance Manuals.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than one single type is specified for an application, selection is Installer's option, but provide single selection for each product category.

B. Plastic Duct Markers:

1. General: Provide manufacturer's standard pre printed flexible or semi rigid, permanent, color coded, plastic sheet pipe and duct markers.
2. Color: Color of pipe and duct markers shall comply with ANSI A13.1.
3. Color: Color of duct markers shall comply with the table below:

System	Background	Lettering
Supply Air	Blue	White
Return Air	Gray	White
Exhaust/Relief Air	Black	White
Outside Air	Green	White
Hazardous Exhaust Air	Orange	Black

4. Small Pipes: For external diameters not greater than 6" (including insulation if any), provide full band pipe markers extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap on application of pre tensioned semi rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 3/4" wide full circle at both ends of pipe marker, tape lapped 1 1/2".
5. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full band or narrow strip type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - a. Laminated or bonded application of pipe marker to pipe (or insulation).
 - b. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of pipe marker, tape lapped 3".

- c. Strapped to pipe (or insulation) application of semi rigid type, with manufacturer's standard stainless steel bands.
 6. Ducts: Provide either full band or narrow strip type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - a. Laminated or bonded application of marker to duct (or insulation).
 - b. Taped to duct (or insulation) with color coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of marker, tape lapped 3".
 - c. Install labels on all ductwork in mechanical rooms and in areas outside of the mechanical room unless specifically noted otherwise. Labels shall be placed at maximum intervals of 20 feet and near all branch take-offs and shall include the connected equipment (AHU, EF, etc.) and system type per the colors defined above.
 7. Lettering: Manufacturer's standard pre printed nomenclature which best describes piping system in each instance, as selected by Design Professional in cases of variance with names as shown or specified.
 8. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.
- C. Plastic Tape:
1. General: Manufacturer's standard color coded pressure sensitive (self adhesive) vinyl tape, not less than 3 mils thick.
 - a. Width: Provide 1 1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2 1/2" wide tape for larger pipes or ducts.
 - b. Color: Same as indicated for Plastic Pipe or Duct Markers.
- D. Valve Tags:
1. Brass Valve Tags: Provide polished brass valve tags with stamp engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 7/16" high, and with 3/16" hole for fastener. Tag thickness 0.040 inches.
 - a. Provide 2" diameter tags, except as otherwise indicated.
 - b. Fill tag engraving with black enamel.
 2. Plastic Valve Tags: Provide red heavy plastic tag with 7/16" white embossed sequenced numbers.
 3. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S hooks or heat sealed braided copper wire of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- E. Name Plates:
1. General: Provide manufacturer's standard preprinted plastic, brass, or aluminum with stamped, engraved or embossed letters.
 2. Lettering:
 - a. Large Equipment: 1 1/2" lettering as appropriate.

- b. Small Equipment: 3/4" lettering as appropriate.
- 3. Attachments: Mounting holes and screws, pressure sensitive adhesive backing, or solid brass chain.

2.2 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of HVAC systems and equipment.
 - 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. General Installation Requirements:
 - 1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags, install identification after completion of covering and painting if any. Install identification prior to installation of acoustical ceilings and similar concealment.
- B. Ductwork Identification:
 - 1. Access Doors: Provide stenciled or plastic laminate type signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
 - 2. Locate duct markers, color bands, and flow direction arrows at all duct installations, including exposed ductwork, ductwork above ceilings (both accessible and inaccessible ceilings), and within view of any points of access (access doors, manholes, etc.). The only locations where duct labels are not required are on ductwork concealed behind or within inaccessible walls and within inaccessible chases or shafts. When installing markers and flow arrows, they shall meet the following provisions:
 - a. Visible from the floor.
 - b. Near each valve and control device.
 - c. Near each branch, excluding short take offs for equipment connections.
 - d. Near major equipment and at other points of origination and termination.
 - e. Near locations where ducts pass through walls or floors/ceilings, or enter non accessible enclosures.
 - f. Spaced intermediately at maximum spacing of 20' along each duct run with a minimum of one marker in each room.

3. Duct markers shall include AHU number (RTU-##), system, and flow direction arrows.

C. Equipment Identification:

1. General: Provide equipment identification for all equipment including rooftop units, , VAVs , control panels.
2. Labeling: All equipment shall be labeled as designated by Owner or per construction document plan marks.
3. Provide identification by means of nameplates or stenciled painting as appropriate.
 - a. For equipment with factory furnished casing, identification shall be by adhesive fixed name plates.
 - b. Field insulated items, such as heat exchangers may be identified by plastic pipe markers or stenciled lettering.
 - c. For equipment with little to no flat surfaces, provide brass tags with chains attached to the equipment.

END OF SECTION 230553

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SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary to install insulation to all hot and cold surfaces of piping, ductwork, tanks, fittings and other surfaces as required by the drawings and this section.
- B. Insulation shall include insulating materials, jackets, adhesive, mastic coatings, tie wire and other materials as required to complete the insulating work.

1.3 DEFINITIONS

- A. Conditioned Space: An area inside the building which is heated and/or cooled.
- B. Tempered Space: An area inside the building which is not directly heated or cooled, but is adjacent to a heated or cooled space with no insulation separating the two spaces (e.g., ceiling plenums).
- C. Untempered Space: An area inside the building which is not conditioned and is not tempered (e.g., attic spaces).
- D. Exterior Space: An area outside the building including thickness of roof/insulation and exterior wall construction. (e.g., roof mounted items).

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Insulating materials, jackets, mastics, etc., shall meet flame spread and smoke developed ratings in accordance with NFPA-90A. Flame spread rating of not more than 25, smoke developed rating of not more than 50 as tested by ANSI/ASTM E84 (UL 723) (NFPA 255) method. All accessory items such as PVC jacketing and fittings, adhesive, mastic, cement tape and cloth shall have the same component ratings as specified above.
- B. Installation of insulation materials shall be in accordance to the latest edition of MICA/NIAC National Commercial & Industrial Standards for the appropriate material application.

- C. NFPA Compliance: Fire Barrier Duct Wrap systems shall meet requirements of NFPA 96 for grease duct application.

1.5 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data: provide one submittal containing the following information:
 - 1. Manufacturer's specifications and installation instructions for each type of HVAC insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each HVAC system requiring insulation.

1.6 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.
 - b. Include manufacturer's maintenance information.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water, and chemical and HVAC damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Insulating Materials
 - 1. Owens/Corning Fiberglass Corp.
 - 2. Armacell.
 - 3. Pittsburgh Corning Corp.
 - 4. CertainTeed Corp.
 - 5. Knauf Fiber Glass
 - 6. John's-Manville Corp.
 - 7. Aeroflex
- B. Mastics and adhesives as recommended by insulation manufacturer.

2.2 DUCT INSULATION

- A. Duct Covering: Johns Manville Microlite Standard or equivalent fiberglass duct wrap with factory applied Foil Scrim Kraft (FSK) vapor barrier jacket, maximum thermal conductivity of 0.28/0.26 (Out-Of-Package/Installed-Compressed) and 1.0 pound per cubic foot density. Provide insulation with black jacket for areas where insulation is exposed and all items are to be painted black.
- B. Rigid Duct Covering: Johns Manville or equivalent semi-rigid fiberglass insulation board with a factory applied Foil Scrim Kraft (FSK) vapor barrier jacket, maximum thermal conductivity of 0.25 and three (3) pound per cubic foot density. Exterior rigid duct insulation to be covered with VentureClad 1577CW multilayered, self-adhesive jacketing system.
- C. Exterior Duct Insulation:
 - 1. Insulation board : Rigid closed cell polyisocyanurate foam with minimum nominal density of 2.0 lb/cu ft and thermal conductivity no higher than 0.19 at 75 deg F after 180 days and maximum water vapor permeability of 4 perm inch and maximum water absorption of 2% by volume. Insulation shall have minimum 24 psi parallel and 13 psi perpendicular compressive strength and rated for -250 deg F to 900 deg F.
 - 2. Jacket: Multi-layered self-adhesive water proof jacketing system. VentureClad 1577CW or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Use only experienced applicators regularly engaged in the trade. Rough work will be rejected. Application details shall be in accordance with the insulating materials supplier's recommendations except where a higher standard is specified. All surface finishes shall be extended in such a manner as to protect all raw edges, cuts and surfaces of insulation.
- B. All piping shall be insulated unless specifically noted otherwise. Piping not noted in the table below shall be insulated with thicknesses matching ASHRAE 90.1 based on the fluid temperatures.

3.2 DUCT INSULATION APPLICATION

- A. Unless specifically indicated to not be insulated, all ductwork and accessories shall be either lined or covered. Duct systems not listed or without a type or thickness indicated on the plans shall be insulated with 1-1/2" wrap.

3.3 DUCT COVERING INSTALLATION

- A. Inspect all ductwork and equipment before applying insulation to ensure the installing contractor has completed all leak tests, and that all surfaces are clean, dry and ready for application of insulation.
- B. Covering shall be cut slightly longer than circumference of duct to insure full thickness at corners. All insulation shall be adhered with edges tightly banded. Butt all insulation joints firmly together. All penetrations, joints, seams and damage to facing shall be sealed with an FSK, PSK or foil tape, adhered with the manufacturers recommended squeegee.
- C. The insulation shall be secured to the bottom of all ducts 18" or wider by means of grip nails and speed clips, placed a maximum of 12" on center. The protruding ends of the pins shall be cut off flush after the speed clips have been applied. Pins shall be securely fastened, loose or unattached pins will not be accepted. The vapor barrier facing shall be thoroughly sealed with a vapor barrier mastic and tape where the pins have pierced through.
- D. Insulation for "cold" ducts and accessories shall pass unbroken through hangers, sleeves, fire dampers, flexible connectors, reheat coils, etc. as required to prevent condensation. All details of covering for cold surfaces shall be such that continuous covering with unbroken vapor barrier and uncompressed insulation is provided. The same covering and hanging detail shall be used for ducts connecting to vibrating equipment or carrying pulsating pressures to avoid metal contact between ducts and hangers. Rigid insulation inserts shall be installed at trapeze hangers, taped to the duct wrap and extend a minimum of 2" beyond the hanger. Insulation Contractor shall be responsible for coordination with equipment suppliers as required to ensure continuous covering of unlined equipment components, i.e. VAV terminal unit supply collar and exposed reheat coil u-bends, fan coil unit discharge, etc.
- E. Insulation at all access points shall be fabricated in such a manner that it can be readily removed without damage to the insulation. Removable insulation shall have a vapor proof cover fabricated so as to allow it to be resealed to the equipment vapor barrier.
- F. Exterior ductwork foam board insulation shall be installed in multiple layers with staggered joints/seams. Slope top insulation on top of rectangular ductwork to provide proper drainage as required by jacketing manufacturer.
- G. Longitudinal joints shall be mechanically fastened with outward clenching staples.

END OF SECTION 230700

SECTION 230900 – BUILDING AUTOMATION SYSTEM (BAS)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements Division 23 – HVAC, Division 26 – Electrical, Division 27 – Telecommunications, and Division 28 – Electronic Safety and Security are applicable to work required of this section.
- B. Coordination:
 - 1. Coordination Required by BAS Contractor: The BAS Contractor shall provide all required information, material, direction and installation instructions to the designated contractor as required to allow this work to be completed in a timely/cost effective manner. This includes, but is not limited to, the following:
 - a. Coordinate with Sheet Metal Contractor prior to the submittal of ductwork shop drawings:
 - 1) Locations of all sensors, dampers, etc., ensuring accurate readings/operation and required access.
 - b. Coordinate with Testing and Balancing Contractor:
 - 1) Provide support and coordination with Testing and Balancing (TAB) Contractor for all interfaces between controls and TAB scope of work. Provide all devices and timely access to the BAS for TAB Contractor use in completing TAB procedures.
 - c. Coordinate with Electrical Contractor:
 - 1) Quantities and locations for dedicated line voltage power requirements for powering BAS panels and devices.
 - 2) If additional line voltage power is required for the operation of the BAS beyond the scope shown on the plans, it is the BAS Contractor's responsibility to provide the additional power; however, this work shall be performed by a qualified Electrical Contractor in accordance with the requirements of Division 26 specifications and included in the BAS Contractor's bid.
 - 3) Quantities and locations of additional junction boxes required for controls components installed in electrical wiring systems (e.g. current sensor, relays, etc.).
 - d. Coordinate with Telecom Contractor:
 - 1) Quantities and locations of information outlet(s).
 - 2) If additional information outlets are needed beyond the quantity shown on the plans, it is the BAS Contractor's responsibility to provide these additional outlets. This work shall be performed by a qualified Telecom Contractor in accordance with Division 27 specifications and included in the BAS Contractors bid.
 - e. Coordinate with Fire Alarm Contractor:
 - 1) Quantities and locations for all points of connection between the BAS and fire alarm system.

- f. Coordinate with Commissioning Agent:
 - 1) Provide support and coordination with Commissioning (Cx) Agent for all commissioning activities. Provide timely access to the BAS for Commissioning Agent use in completing commissioning procedures. Correct any deficiencies discovered during the commissioning process.
- 2. Work by Others: The following incidental work shall be furnished by the designated under the supervision of the BAS Contractor.
 - a. Sheet Metal Contractor shall:
 - 1) Provide access door or other approved means of access through ducts for service to control equipment.

1.2 DESCRIPTION OF WORK

- A. Provide an extension of the existing Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project. All new building controllers, and equipment/plant controllers, shall be integrated into the existing BAS.
 - 1. The existing BAS is a Trane Tracer® system.
 - 2. The upgraded BAS shall support integration with existing legacy equipment without the need for additional gateways or converters. The upgraded BAS shall provide full functionality equivalent to the original legacy system, including monitoring, control, and alarm management. The BAS must support the transition to modern BAS standards while maintaining backward compatibility with existing equipment.
 - 3. Comprehensive documentation must be provided prior to acceptance, detailing the integration process and any specific requirements for legacy equipment.
 - 4. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.
 - 5. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.
 - 6. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.

7. Approved vendors, products and web services shall comply with SOC2 Type II as defined by the AICPA. SOC2 Type II compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).
 - a. SOC2 Type II compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.
 - b. To achieve SOC2 Type II compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.
 8. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.
- B. Manage and coordinate the BAS system work in a timely manner in consideration of the project schedule. Coordinate cooperatively with the associated work of other trades so as to assist the progress and not impede or delay the work of associated trades.

1.3 QUALIFICATIONS

- A. BAS Manufacturer Qualifications
1. The BAS manufacturer shall have an established business office within 50.00 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.
 2. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.
 3. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.
 4. Independent representatives of BAS manufacturers are not acceptable. BAS vendor must be corporate owned entity of BAS manufacturer.
- B. Control system components shall be the manufacturer's latest standard of design at the time of bid and in conformance with the following applicable standards for products specified.

1.4 QUALITY ASSURANCE

- A. The building automation system and components shall meet the following regulatory requirements:
1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 2. Federal Communications Commission -- Part J.
 3. ASHRAE/ANSI 135-2012 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.
 4. ASHRAE/ANSI 135-2012 (BACnet) - (Unit Level Devices) - Unit Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.
 5. American Society for Testing and Materials, ASTM.
 6. Institute of Electrical and Electronic Engineers, IEEE.
 7. National Electrical Manufacturers Association, NEMA.
 8. Electronics Industries Alliance, EIA.
 9. National Fire Protection Association, NFPA.
 10. National Electrical Code, NEC.
 11. American Society of Heating, Refrigeration, and Air-Conditioning Engineers, ASHRAE, (ASHRAE Standard 135 The BACnet Standard).
 12. American National Standards Institute, ANSI (ANSI 568 Commercial Building Telecommunications Cabling Standard).
 13. Underwriters Laboratory, UL (UL 916 Energy Management Systems).
 14. FCC Regulation, Part 15.
 15. Local building codes.

1.5 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. The following shall be submitted for approval prior to commencing construction of the BAS:
1. Contractor Qualifications: Document compliance with qualification requirements listed above. Include names, email addresses, and phone numbers of the project manager, primary programmer, electrical sub-contractor, and other team members.
 2. BAS Design Submittal, including:
 - a. A bookmarked PDF with bookmarks for each plan sheet with title and number, each schedule, and each product cut sheet with appropriate description.
 - b. A table of contents listing sheet titles and sheet numbers.
 - c. A floor plan showing the proposed locations of all network controllers.
 - d. BAS network architecture diagrams including all controllers, repeaters, gateways, interconnections, etc.

- e. Calculations showing that system architecture can support the minimum trending and data storage requirements of the project with a written guarantee that the final installation will meet the project trending and storage requirements.
 - f. Schematics with accurate arrangement of devices as they relate to the equipment.
 - g. Sequences and points lists as intended to be installed and programmed. A direct copy of the sequences and points lists from the plans will not be acceptable.
 - h. Points schedule for each physical point shown on the schematics, including: tag, point type, system name and display units.
 - i. Point-to-point wiring diagrams including start-stop arrangement for each piece of equipment, equipment interlocks, controller wiring terminal numbers and any special connection information required for properly controlling the HVAC equipment.
 - j. Control damper schedule including a separate line for each damper and a column for each of the damper attributes, including: associated system, associated equipment, part number, fail position, damper type, damper operator, blade type, bearing type, seals, duct size, damper size, damper material, mounting, and actuator type.
 - 1) Power calculations for all control damper actuators and corresponding transformer selections.
 - k. Control valve schedules including a separate line for each valve and a column for each of the valve attributes: associated system, associated equipment, part number, configuration, fail position, pipe size, valve size, valve type, valve material, close off pressure, capacity, valve CV, calculated CV, design pressure, actual pressure, and actuator type.
 - 1) Power calculations for all control valve actuators and corresponding transformer selections.
 - l. Network Architecture Schedule arranged/organized by building areas and/or rooms/spaces.
 - m. Controller schedule including a separate line for each controller and a column for each of the valve attributes: associated system, associated equipment, part number, configuration and optional features.
 - n. Airflow measuring station schedules including a separate line for each AFMS and a column for each of the AFMS attributes: associated system, associated equipment, part number, type, duct/fan inlet size, AFMS material, velocity range, and design airflow.
 - o. Product cut sheets including manufacturer's catalog data describing each item of control equipment or component provided and installed for the project. Cut sheets shall include performance data as applicable (e.g. valve Cv, damper pressure drops, operating range, sensor accuracy, sensor units, sensor, sensor hysteresis, sensor stability, etc.).
 - p. Product cut sheets for the operator workstation and any data storage devices including all technical specifications.
 - q. Product installation instructions.
- C. The following shall be submitted for approval a minimum of two months prior to substantial completion:
- 1. Floor plan graphics.

2. One sample graphic of each different equipment arrangement included on the project and overall floor plans indicating equipment, master controller locations and communication bus routing. Graphics that are not identical (except for equipment labels) need to be submitted as separate graphics.

1.6 SYSTEM PERFORMANCE

A. Performance Standards. The BAS system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.
2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.
3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.
4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.
5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

1.7 SOFTWARE LICENSES

- ### A.
- Provide required copies of all licenses for software, including software licenses on local workstations and software loaded or embedded into controllers or other network devices. BAS licensing shall allow for unlimited access to the system; no restrictions shall be placed on the licensing. All software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

1.8 CLOSEOUT REQUIREMENTS

- ### A.
- Refer to Division 01 Closeout requirements.
- ### B.
- Within one month prior to project substantial completion, calibrate all CO₂ and specialty gas sensors and generate calibration reports. Turn over all calibration kits to the Owner.

- C. All relative humidity sensors shall not be ordered or installed until the project is within 6 months of substantial completion. If sensors are installed prior to that date, they shall be recalibrated within one month prior to substantial completion.
- D. Provide instructions on how to calibrate all sensors on the project. If a sensor cannot be field recalibrated but has the ability for replacement calibrated parts, include a source for obtaining the replacement parts.
- E. Provide O&M Manual. Refer to 230010 for Operation and Maintenance (O&M) and Owner training requirements. Include the following:
 - 1. Manufacturer's catalog data and specifications for all products and devices.
 - 2. A copy of all device calibration reports and certifications (e.g. NIST).
 - 3. Certificate of Demonstration for Owner training on the BAS as specified in section 23 0100.
 - 4. Owner instruction manual to include the following to the Owner's satisfaction:
 - a. Instruction for all operations of the system.
 - b. Instructions on how to calibrate all sensors. If a sensor cannot be field calibrated but has the ability for replacement calibrated parts, include a source for obtaining replacement parts.
 - c. Reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
 - d. Instructions on how to perform programming functions.
 - e. Glossary of terms and common acronyms.
 - 5. A copy of the warranty.
- F. Provide as-built documentation in the same format as the BAS Design Submittal, updated with all revisions and as-built conditions after the system demonstration has been performed. In the BAS graphics, include a link from the BAS to the final as-built documentation. Provide a copy of the as-built point-to-point wiring diagrams and final programmed sequence inside each control panel enclosure. Also indicate exact installed locations on the floor plans for the following :
 - 1. All network controllers
 - 2. Pump differential pressure sensors
 - 3. Fan differential pressure sensors
 - 4. Outdoor air temperature and/or humidity sensor
- G. Provide a warranty on the entire system, including software, hardware, and labor. Refer to 230010 for warranty requirements. Provide an extended five (5) year warranty on all control valves and control valve actuators.
 - 1. In the last month of the warranty period, all BAS software and controller firmware, software, drivers, etc., shall be upgraded and validated to the latest release (version) in effect at the end of the warranty period.
 - 2. At the end of the warranty period, the final version of all BAS software and programming shall be fully backed up on external storage device(s) (e.g. CD, USB drive, etc.). Include all software licenses. Turn the external storage device over to the Owner.

1.9 PRE-PROGRAMMING DESIGN REVIEW MEETING

- A. Prior to starting programming, a design review meeting shall be scheduled with the Design Professional. The agenda of this meeting will be to discuss the design intent, review all systems requiring control, review naming conventions, and answer any questions the Temperature Controls Contractor may have.

1.10 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 01 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, acceptable manufacturers are as follows:
 - 1. Trane Controls – Cedar Rapids Office

2.2 SYSTEM ARCHITECTURE

- A. The complete electronic BAS system may be comprised of the following levels of control devices.
 - 1. Central File Server shall store all data required by the system and be permanently connected to the network.
 - 2. Network Controller(s) are used for high level global programming functions and system networking.
 - 3. Local Controllers are for control of large primary HVAC systems such as air handling systems, heating hot water systems and chilled water systems.
 - 4. Application Specific Controllers are dedicated for specific equipment such as VAV boxes, fan coils, and heat pumps.
 - 5. Repeaters are used for communication signal enhancement along the Tier 2 network.
 - 6. Gateways are used to allow communication between two different communication protocols.
 - 7. Network thermostats dedicated to specific equipment such as VAV boxes, fan coils, or heat pumps, etc.
 - 8. Field devices include, but are not limited to, electronic sensors, valves, actuators, switches, relays, and transducers.
 - 9. Tier 1 level network is the main backbone of the system and shall be an Ethernet Local Area Network (LAN). All network controllers, the Operator Workstation, and the Central File Server shall be connected directly to this network without the need for gateway devices.

10. Tier 2 level networks are the communication busses managed by the network controllers. Local Controllers and Application Specific Controllers shall reside on a Tier 2 communication bus without any third-party controllers. All third-party controllers shall reside on a Tier 2 communication bus dedicated to third-party controllers.
- B. Data throughout any level of the network shall be available to and accessible by all other devices, controllers, the Central File Server, and the Operator Workstation.
- C. Interruptions or faults at any point on the network shall not interrupt communications between other nodes on the network.
- D. The BAS network shall support both copper and optical fiber communication media.
- E. All line drivers, repeaters, signal conditioners, etc., shall be provided as necessary for proper data communication.
- F. The system shall use the same application programming language for all levels.
- G. The system shall be configured as a distributed processing network(s) capable and shall be scalable and expandable at all levels of the system using the same software interface and the same types of controllers. Systems that require replacement of either the workstation software or any controllers to expand the system shall not be acceptable.

2.3 VARIABLE AIR SYSTEM - COMMUNICATIONS

- A. System Communications
 1. Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet protocol with an Ethernet (IEEE 802.3, 802.11), RS485 (EIA-485), or Zigbee (802.15.4) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet IP, BACnet IPv6, BACnet MS/TP, BACnet Zigbee).
 2. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.
 3. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.
 4. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.
 5. For minimally managed IP networks, BACnet communication shall support BACnet Secure Connect (BACnet/SC), a secure and encrypted datalink layer specifically design for those networks.
- B. Field Bus Communications
 1. BACnet
 - a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.

- b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.
- c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.
- d. BACnet Zigbee
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.
 - 2) Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
 - 3) Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
- e. BACnet MS/TP
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.
- f. Points within LonTalk equipment/plant controllers shall be exposed as standard BACnet points within the System Controller without need for manual intervention by an operator.

2.4 VARIABLE AIR SYSTEM - OPERATOR INTERFACE

- A. Provide Operator Web Interface to allow system operators to view and adjust Variable Air System status, set-points and alarms.
 - 1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
 - 2. The building operator web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
 - 3. User Roles
 - a. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
 - b. User logon/logoff attempts shall be recorded.
 - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
 - 4. On-Line Help and Training
 - a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
 - b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

5. Equipment and Application Pages
 - a. The operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
 - 1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
 - a) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
 - b) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
 - 2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
 - 3) Historical Data (As defined in Data Log section below) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
6. Provide Variable Air System graphics: An operator shall be able to view and control (where applicable) the following parameters via the operator web interface:
 - a. System Mode
 - b. System Occupancy
 - c. Ventilation (Outdoor air flow) setpoints
 - d. Ventilation (Outdoor air flow) status
 - e. Air Handler Static pressure setpoint
 - f. Air Handler Static pressure status
 - g. Air Handler Occupancy status
 - h. Air Handler Supply air cooling and heating set points
 - i. Air Handler minimum, maximum and nominal static pressure setpoints
 - j. VAV box minimum and maximum flow
 - k. VAV box drive open and close overrides
 - l. VAV box Airflow to space
 - m. Average space temperature
 - n. Minimum space temperature
 - o. Maximum space temperature
7. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
 - a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
 - b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
 - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator

8. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program
9. Manual Control and Override.
 - a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
 - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
 - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
 - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
10. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.
11. Alarm/Event Notification
 - a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
 - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
 - 2) The operator shall be able to acknowledge and add comments to alarms
 - 3) Alarm/event messages shall use full language, easily recognized descriptors.
 - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.
12. Reports and Logs.
 - a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
 - b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
 - c. The following standard reports shall be available without requiring a user to manually configure the report:
 - 1) All Points in Override Report: Provide an on demand report showing all overrides in effect.
 - 2) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
 - 3) All Points in Alarm Report: Provide an on demand report showing all current alarms.
 - 4) Points report: Provide a report that lists the current value of all points
 - d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

B. Provide Mobile App Interface

1. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required). This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
2. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android operating systems.
3. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.
4. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).
5. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
6. The operator interface shall support system access on a mobile device via a mobile app to:
 - a. Alarm log
 - b. System Status
 - c. Equipment status
 - d. Space Status
 - e. Standard Equipment graphics
 - f. Override set points
 - g. Override occupancy
 - h. Acknowledge Alarms
 - i. Add Comment(s) to Alarms

2.5 VARIABLE AIR SYSTEM - CONTROLLER SOFTWARE

- A. Variable Air System Controls Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.
- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.
 1. VAV Air Systems Applications
 - a. The BAS shall provide air system applications that coordinate air handlers (AHU)/rooftop units (RTU) and Variable Air Volume Terminal equipment.
 - b. The air system applications shall perform the following functions:
 - 1) Startup and shutdown the air handler safely. Ensure the VAV boxes are open sufficiently when the air handler is running, to prevent damage to the ductwork and VAV boxes due to high air pressure.

- 2) Optimized Control of Supply Duct Static Pressure (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling system static pressure to the lowest level while maintaining zone airflow requirements. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
 - 3) During commissioning, and with the engineer/owner, the controls contractor shall confirm the performance of Optimized Control of Supply Duct Static Pressure by conducting a field functional test that demonstrates critical zone reset.
 - 4) Demand Controlled Ventilation – the active ventilation setpoint shall modulate between the occupied ventilation and occupied standby ventilation setpoint; Resetting the setpoint based on CO2 levels in the space.
- c. The Air Systems application shall provide a user interface that includes status of current system operation with real time data of key operating parameters. Key operating parameters for Guideline 36 include:
- 1) Duct Static Pressure
 - 2) Duct Static Optimization Setpoint
 - 3) Ventilation Optimization Setpoint
 - 4) Ventilation Optimization Maximum VAV Vent Ratio/Source VAV box
 - 5) Discharge Air Temperature
 - 6) Duct Static Optimization System Requests
- d. The air system application status screens shall explain what optimization calculations are occurring, critical parameters, and source equipment members.
- e. The air systems applications shall provide a user interface that enables configuration changes made by swipe and type fields, selection list, and check box entry for feature definition:
- 1) VAV Auxiliary Night Heat
 - 2) VAV Source Temperature Distribution
 - 3) Start/Stop Delay operation
 - 4) Enable/Disable Optimization Strategies
- f. The operation of VAV Terminal equipment members of the VAV Air System shall be selected by check box to optionally participate in the following functions:
- g. The air system application vendor shall provide a published applications guide that details the air system application operation, configuration, setup, and troubleshooting. The applications guide documentation shall be maintained under version control, and updated by the manufacture to reflect most recent feature updates as made available. Contents of the guide shall include:
- 1) Description of System Operation
 - 2) Required Components
 - 3) Sequences of Operation
 - 4) Installation
 - 5) Controller Setup
 - 6) Required Programming
 - 7) Commissioning
 - 8) Optimization Strategies
 - 9) Special Applications
 - 10) Troubleshooting

- h. The air system application shall present in plain user language the current operation with source zone information and reset events.

C. Trend Logs

1. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.
 - a. Variable Air System (VAS)
 - 1) Duct Static Optimization Duct Static Setpoint
 - 2) Space Temperature Average
 - 3) Ventilation Optimization Air Setpoint
 - 4) Operating Mode
 - 5) Duct Pressure Optimization Maximum
 - b. Air Handling Unit/Rooftop (VAV)
 - 1) Discharge Air Temperature
 - 2) Discharge Air Temperature Setpoint Active
 - 3) Space Temperature Active
 - 4) Cooling Capacity Status
 - 5) Discharge Air Flow
 - c. VAV box
 - 1) Discharge Air Temperature
 - 2) Space Temperature Active
 - 3) Space Temperature Setpoint Active
 - 4) Air Flow Setpoint Active
 - 5) Discharge Air Flow

2.6 VARIABLE AIR SYSTEM - BUILDING / SYSTEM CONTROLLERS

- A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
 1. The controller shall provide a USB communications port for connection to a PC.
 2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 3. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
 4. Data shall be shared between networked System Controllers.
 5. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
- B. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

2.7 VARIABLE AIR VOLUME TERMINAL UNIT CONTROLLERS

A. General Description

1. Variable Air Volume (VAV) controllers shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are typically not user programmable, but are configurable for operation of VAV terminal units.
2. Variable Air Volume (VAV) controllers are controllers that operate equipment that control the space temperature of single zone.

B. The VAV controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

C. When the VAV controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. The VAV controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the following: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
2. The VAV controller will provide equipment status parameters to the BAS through BACnet communication.
3. The VAV controller will operate as a stand-alone controller in the event of communication failure with the BAS.
4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

D. Stand-Alone Operation: Each VAV Terminal Unit shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.

E. The VAV controller shall communicate to the building automation system via one of the following protocols: BACnet™ MS/TP, BACnet™ Zigbee or BACnet™ IP as defined in ANSI®/ASHRAE® Standard 135-2020.

1. BACnet™ MS/TP

- a. To allow maximum communications speed and co-existence with other controllers, the controller shall support at a minimum the following BACnet MS/TP manager baud rates: 9600, 19200, 38400, 76800.

2. BACnet™ IP

- a. BACnet IP controllers provide BACnet communications over Internet Protocol via Local Area Networks (LAN), an open standard building automation communication protocol that enables connections to other building automation systems and controllers

3. BACnet™ Zigbee

- a. VAV controller wireless communication interface shall self-form and self-heal to maintain operation in the event of network communication failure.
- b. IEEE 802.15.4 radios to minimize risk of interference, reliability, and range.

- c. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
 - d. To protect against harmful interference, certifications shall include Energy Management Equipment FCC CFR47, Section 15.247 & subpart E, Digital Modulation Transmission with no SAR (FCC ID: TPF-251701)
- F. Each VAV terminal unit shall use a space zone sensor(s) to measure the space condition it is serving.
 - 1. The VAV controller shall use a wired communication interface to connect to its space zone sensor.
 - 2. Each zone sensor communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
 - a. Zone temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
- G. Software
 - 1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 - 2. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
- H. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - 1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
 - 2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
 - 3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - 4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].
- I. Input/Output:
 - 1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 - 2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, and 200 to 20Kohm.
 - 3. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 - 4. For flexibility in selection and replacement devices, the controller shall have binary output which are able to drive at least 12VA each.
 - 5. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).

- J. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 2. All binary output shall have LED's indicating the output state.
 3. All wiring connectors shall removable without the use of a tool.
 4. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.
 5. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
 6. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 7. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
 - a. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
 8. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
 - a. Trends shall be capable of being collected at a minimum sample rate of once every second.
 - b. Shall be capable of trending all BACnet points used by controller
 - c. Trends shall be capable of being scheduled or triggered
- K. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- L. Controller shall meet the following Agency Compliance:
1. UL916 PAZX, Open Energy Management Equipment
 2. UL94-5V, Flammability
 3. FCC Part 15, Subpart B, Class B Limit
 4. AS/NZS CISPR 32:2016
 5. VCCI-CSPR 32:2016
 6. CAN ICES-003(B)/NMB-003(B)
 7. To ensure integration to the building automation system the controller must be BTL (BACnet Testing Lab) listed. The following BACnet profiles are in order of most functionality (B-BC) to least functionality (B-ASC).
 - a. BACnet Building Controller (B-BC)
 - b. BACnet Advance Applications Controller (B-AAC)
 - c. BACnet Application Specific Controller (B-ASC)

2.8 INPUT/OUTPUT INTERFACE:

- A. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.

- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.9 POWER SUPPLIES:

- A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
 - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA approved.

2.10 AUXILIARY CONTROL DEVICES:

A. Binary Temperature Devices

- 1. Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
- 2. Line-voltage space thermostat shall be bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

B. Wired Temperature Sensors

- 1. Temperature sensors shall be RTD or thermistor.
- 2. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m² (10 ft²) of duct cross section.
- 3. Space sensors shall be equipped with setpoint adjustment, override switch, display, and/or communication port as shown on plans.
- 4. Provide matched temperature sensors for differential temperature measurement.

C. Wired Humidity Sensors

- 1. Duct and room sensors shall have a sensing range of 20% to 80%.
- 2. Duct sensors shall be provided with a sampling chamber.

D. Static Pressure Sensors

- 1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
- 2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

2.11 REPEATERS AND SIGNAL CONDITIONERS

- A. Provide a repeaters and signal conditioners at locations in the controls network where required.
- B. Humidity Sensors:
 - 1. Space Sensors:
 - a. Humidity sensors shall be of the solid-state type using a hygroscopic polymer or thin film capacitive sensing element.
 - b. Sensors shall be available in an off-white ventilated enclosure, unless noted otherwise on the plans. Sensor shall be able to be mounted on a standard electrical box.
 - c. Accuracy: +/- 3% over a range of 0-90% non-condensing.
 - d. Stability: +/- 1% annually over 2 years.
 - 2. All humidity sensors shall be able to be recalibrated in the field or the sensing tip to be replaced without replacing the entire sensor.
- C. Carbon Dioxide (CO2) Sensors:
 - 1. Sensing Technology: Non-Dispersive Infra-Red (NDIR) with single lamp, dual wavelength.
 - 2. Range: 0 – 2,000 ppm or 0 – 5,000 ppm as required based on the control and alarm concentrations indicated on the plans. If no concentrations are indicated, use 0 – 2,000 ppm.
 - 3. Accuracy: +/- 2% of range or 2% of reading.
 - 4. Stability: +/- 5% over 5 years.
 - 5. Provide with one CO2 calibration kit for the entire project. Kit shall include two 17-liter CO2 calibration gas cylinders, one at 200 ppm and one at 1,000 ppm. Also provide a gas regulator, tubing, fittings, adapters, sensor cones, etc., as required for the application.
- D. Differential Pressure Sensor: Differential pressure sensor shall be temperature compensated and shall vary the output voltage with a change in differential pressure. Sensor shall have a non-repeatability of +/- 0.05% of range. Sensor shall be capable of withstanding up to 150% of rated pressure without damage.
 - 1. Duct differential pressure sensors shall have an appropriate range for the application with a minimum accuracy of +/- 1% of range. Approved probe manufacturer – Mamac A-520-2-A-1
 - a. Sensors in positively pressurized ductwork (typically downstream of the supply fan) shall only have a positive range.
 - b. Sensors in negatively pressurized ductwork (typically upstream of a fan) or between fans in series (typically in an air handling unit) shall have both a negative and positive range.
 - c. Sensors shall have manual reset mounted for easy accessibility.
 - 2. Room differential pressure sensors shall have a range of -0.25" w.c. to 0.25" w.c. and a minimum accuracy of +/- 0.5% of range.
 - 3. Underfloor plenum differential pressure sensors shall have a range of 0" w.c. to 0.25" w.c. and a minimum accuracy of +/- 0.5% of range.

4. Building differential pressure sensors shall have a range of -0.25" w.c. to 0.25" w.c. and a minimum accuracy of +/- 0.5% of range. Sensor shall be provided with a pressure sensing tip that incorporates a shield to minimize the effect of wind.
 5. Water differential pressure sensors shall be accurate to +/- 0.5% of range. The housing shall be NEMA 4 rated.
 6. Steam and gas differential pressure sensors shall be accurate to +/- 0.5% of range. The housing shall be NEMA 4 rated.
- E. Air Differential Pressure Switches: Differential pressure switches shall be field adjustable with a range appropriate for the duct pressure classification and include manual reset. The switch shall be capable of withstanding up to 150% of rated pressure without damage. Provide a red pilot lighted reset button located on the control panel that is wired to the manual reset from the switch.
- F. Position Switches: Provide switch that can sense the full closed position and an adjustable open position between 10 and 100%.
- G. Current Switches: Current status switches shall be used to monitor motors and other electrical loads as indicated on the plans. Current switches shall be sized appropriately for their application and available in solid and split core models and offer either a digital or an analog signal to the automation system. The sensing range of the sensor shall be appropriate for the device being monitored. Zero and span adjustments shall be separate.
- H. Audible and Visible Alarms: Horn shall be continuous tone with solid-state electric signal and red LED pilot light. Provide a separate silence button (refer to manual push buttons below) to be mounted at an accessible height. The light shall remain on and the alarm condition active even after the silence button is pressed until the alarm state is resolved.
- I. Pilot Lights: Light shall be LED type with push-to-test function and have an oil-tight enclosure. The light shall be green when indicating normal operation and red when indicating an issue or alarm.
- J. Manual Push Buttons: Button shall be round, approximately 3/4" in diameter. Provide with the quantity and type of contacts required for the application. Submit color options for selection by the Design Professional during submittal review.
- K. Manual Switches: Provide line-voltage toggle switch appropriate for the application. Refer to Division 26.
- L. Relays and Power Supplies: All relays and power supplies shall be mounted in an interface panel directly adjacent to the associated BAS panel and be clearly labeled.
- 2.12 CONTROL WIRING
- A. The term "control wiring" is defined to include providing of wire, conduit, junction boxes, and miscellaneous materials as required for mounting and connecting electric or electronic control devices and network communication devices.
- B. Wiring routed exposed shall be in conduit. All conduit for control wiring shall be blue.

- C. All control wiring and wiring connections required for the installation of the BAS system shall be provided by BAS Contractor unless specifically shown on the electrical or telecommunication drawings or called for in Division 26 or Division 27.
- D. All control wiring shall comply with the requirements of local and national electrical codes.
- E. Control wiring in ducts, air plenums, air moving equipment, and other air handling spaces shall be specifically listed for the use, including wiring provided with field devices.
- F. All wiring shall be labeled at both ends and coordinated with the owner. All termination points shall also be labeled.
- G. BAS components controlling equipment on emergency power shall also be on emergency power.

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspect and examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Install systems and materials in accordance with drawings and details, manufacturer's instructions, reviewed submittals, and contract documents. Install electrical components and use electrical products complying with requirements of applicable Division-26 sections of these specifications.
- C. Where components are installed in potentially wet or corrosive environments, install in an appropriate enclosure. Enclosures shall be of the type as indicated:
 - 1. Components installed in exterior locations or locations subject to moisture shall be installed in a NEMA 4 enclosure.
 - 2. Where possible, do not install components in corrosive environments. However, if the component must be installed in corrosive locations, it shall be installed in a NEMA 4X enclosure.

3.2 INSTALLATION OF CONTROLLERS

- A. Install controllers in accordance with manufacturer's installation instructions and with adequate clearance to allow for maintenance.
- B. Install all controllers in a control panel enclosure. Control panels shall be of the type as indicated:
 - 1. Controllers installed in interior locations shall be installed in a NEMA 1 enclosure.
 - 2. Controllers installed in exterior locations or locations subject to moisture shall be installed in a NEMA 4 enclosure.

3. Where possible, do not install controllers in corrosive environments. However, if the controller must be installed in corrosive locations, it shall be installed in a NEMA 4X enclosure and all associated components shall also be appropriate for the application and shall be approved by the Design Professional prior to installation.
- C. Label all control panel enclosures with the system or equipment served. Network controllers shall be labeled to indicate the general areas of the building served. All labels shall match the designations on the as-built drawings, which shall match the equipment tags on the plans.
- D. Include a copy of the as-built point-to-point wiring diagrams and final programmed sequence inside each control panel enclosure.

3.3 INSTALLATION OF FIELD DEVICES

A. General:

1. Install all field devices where indicated on the plans and in accordance with manufacturer's installation instructions and with adequate clearance to allow for proper operation, maintenance, and removal of the device.
2. Repair pipe insulation to maintain the integrity of the insulation vapor barrier. Use hydraulic insulating cement to fill voids and to repair damages to the factory applied vapor barrier. Finish with material matching or compatible with adjacent jacket material.
3. Repair duct insulation to maintain the integrity of the insulation vapor barrier. Use foil tape to repair damages to the factory applied vapor barrier.
4. Where a field device penetrates a duct or air moving equipment, seal around the penetration to prevent air leakage.
5. All BAS equipment and components shall be identified and labeled.

B. Room/Wall-mounted Sensors:

1. Install at the elevation indicated on the plans.
2. Install plastic guards over sensors with user adjustment where noted on the plans.
3. Provide insulated back panel where sensors are located on the inside face of an exterior wall or on a column enclosure.

C. CO2 Sensors: Within one month prior to project substantial completion, calibrate all sensors. Provide calibration reports as part of the closeout documents.

D. Differential Pressure Sensors:

1. Duct Differential Pressure Sensors: Install in the location in the system shown on the plans. If not shown on the plans, contact the Design Professional.

E. Air Differential Pressure Switches: For a positively pressurized duct, adjust the set point to be 0.25" less than the duct pressure classification rating. For a negatively pressurized duct, adjust the set point to be 0.25" more than the duct pressure classification rating. Unless indicated otherwise on the plans. Refer to the Duct Classification Schedule on the plans for duct pressure classification ratings.

- F. Current Switch: Adjust so that the set point is below the minimum operating current and above motor no load current.
- G. Wall-mounted Audible and Visible Alarms: Install device at 6'-8" above finished floor. Install silence button at 46" AFF and below the audible and visible alarm.
- H. Wall-mounted Push Buttons: Install at the elevation indicated on the plans.
- I. Install manual resets at easily accessible locations.

3.4 INSTALLATION OF CONTROL WIRING

- A. The BAS Contractor shall provide a complete Tier 1 level communication network dedicated to all BAS communications, including all required wiring and network switch(es), as applicable. The BAS Contractor shall only utilize the connection port(s) indicated specifically for BAS use on the telecommunications plans. Additional connection ports shall not be utilized.
- B. Any equipment specified to be on emergency power shall also have all associated controls on emergency power, including all network controllers, local controllers, devices, etc.
- C. Control wiring shall be routed in blue conduit in the following locations: concealed in walls, concealed above inaccessible ceilings, finished areas with exposed structure, inside air moving equipment or ductwork, locations subject to moisture, exterior locations, and in all unfinished spaces, such as mechanical rooms, electrical rooms, etc. Where conduit is in an exterior location or subject to moisture, it shall be rigid and sealed to be watertight. Control wiring shall not share conduit with line voltage wiring.
- D. Control wiring routed to devices in accessible locations may be routed in flexible conduit. The minimum size of the flexible conduit shall be 1/2" and the maximum length shall be 36".
- E. Control wiring concealed by accessible construction may be installed without conduit. Accessible locations include areas such as above accessible ceilings and below accessible floors. Control wiring shall not share cable tray with telecommunications wiring or raceways with any other trade. All wiring shall be neatly routed and tie-wrapped to structural components, supported at least every 4 feet. Excess wire shall be neatly coiled and secured to structure. Under no circumstances shall cable be supported by piping, conduit, ductwork, ceiling tile or ceiling support wires. Cable shall be neatly routed in line with building lines.
- F. Control wiring shall not share cable tray with telecommunications wiring or raceways with any other trade. Nor shall it be supported via cable tray or from other raceways from other trades.
- G. Install all control wiring to meet all manufacturer installation requirements, including not exceeding the maximum cable length, tension, or bend radius. At all building expansion joints, provide means for movement of wiring and conduit that exceeds the expected movement of the building.

- H. Label or color code each control wire at each end. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color coded cable with cable diagrams may be used to accomplish cable identification.
- I. Splices shall not be made in shielded wiring.

3.5 EXAMINATION:

- A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.6 PROTECTION:

- A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.
- B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.7 COORDINATION:

- A. Site
 - 1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
 - 2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- B. Submittals. Refer to the "Submittals," section of this specification for requirements.
- C. Test and Balance
 - 1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

2. The contractor shall provide training in the use of these tools. This training will be planned for a duration of 4 hours.
 3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
 4. The tools used during the test and balance process shall be returned to the contractor at the completion of the testing and balancing.
- D. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
1. All communication media and equipment shall be provided as specified in the "Communication" section of this specification.
 2. Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

3.8 GENERAL WORKMANSHIP:

- A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.
- E. All control device installation and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

3.9 WARNING LABELS:

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS system.

- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

3.10 IDENTIFICATION OF HARDWARE AND WIRING:

- A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.
- C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.
- D. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.11 CONTROLLERS:

- A. Provide a separate DDC Controller for individual HVAC mechanical equipment. BAS manufacturer shall furnish and coordinate DDC controllers and control devices and ensure that installation and wiring adhere to BAS manufacturer's design recommendations. For those mechanical equipment units that do not have factory installed controls specified, the BAS manufacturer shall field mount controls and coordinate all installation and termination information to ensure the specified sequence of operations are met.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.
 - 1. Future use of spare I/O point capacity shall require providing the field instrument and control device, field wiring, engineering, programming, and commissioning. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.12 PROGRAMMING:

- A. Provide sufficient internal memory for all controllers to ensure specified sequence of operations, alarming, trending, and reporting requirements are achieved. BAS manufacturer shall provide a minimum of 25% spare memory capacity for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming

1. Provide programming for individual mechanical systems to achieve all aspects of the sequence of operation specified. It is the BAS manufacturer's responsibility to ensure all mechanical equipment functions and operates as specified in sequence of operations. Provide sufficient programming comments in controller application software to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. BAS Operator's Interface

1. When Operator Workstation is specified, provide color graphics for each piece of mechanical equipment depicting sufficient I/O to monitor and troubleshoot operation. Operator color graphics shall include Chiller Plant, Cooling Tower System, Boiler Plant, Air Handling Units, Rooftop Units, VAV Terminal Boxes, Fan Coil Units, Unit Ventilators, Heat Exchangers, Exhaust Fans, etc. These standard graphics shall depict all points dynamically as specified in the points list and/or indicated in sequence of operation.
2. The BAS manufacturer shall provide all the labor necessary to install, initialize, start up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.
3. As part of this execution phase, the BAS manufacturer shall perform a complete test of the operator interface.

3.13 SYSTEM ACCEPTANCE

- A. System Verification and Testing Procedure: The BAS Contractor shall confirm the system is complete, including all controls installed, graphics complete, and software programs have been completely tested and exercised for proper equipment operation. BAS control panels shall be demonstrated via a functional end to end test such that:
1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
 2. All analog input channels shall be verified for proper operation.
 3. All binary input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
 5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
 6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.
- B. System Demonstration: After the BAS Contractor has confirmed proper operation, acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of the request. At that time, the BAS Contractor shall demonstrate the operation of the system to the Owner's Representative and Design Professional. Any issues are discovered during this demonstration shall be corrected.

- C. Operation and Maintenance Manuals: Submit copies of operation and maintenance manuals as required by this section and section 230010 – HVAC General Provisions.

3.14 TRAINING AND DEMONSTRATIONS

A. Equipment training for Owner:

1. Manufacturer's representatives and contractors shall provide 40 hours (min) instruction BAS components and operation. Training shall occur in several sessions over the course of the first year of operation with a minimum of four separate dates – two for heating season and two for cooling season.
2. Training sessions shall use the printed installation, operation and maintenance instruction materials included in the O&M manuals and emphasize preventative maintenance and safe operating procedures.
3. Training shall be performed by qualified factory trained technicians.
4. HVAC Contractor shall attend all sessions performed by the manufacturer's representative and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
5. Equipment training shall occur as soon as possible after start up of the equipment and shall include hands-on operation.

B. System training for Owner:

1. HVAC and Temperature Controls Contractors shall jointly conduct system operating training. These sessions shall include:
 - a. HVAC system overview.
 - b. System wide start-up.
 - c. Operation of control system.
 - d. Function of each component.
 - e. System operating procedures in all possible modes.
 - f. Programming procedures.
 - g. Shut-down and maintenance procedures.
 - h. Emergency procedures.

END OF SECTION 230900

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary to fabricate and erect ductwork as required by the drawings and this section.
- B. Low velocity ductwork shall apply to the following:
 - 1. Supply: Downstream of terminal units.
 - 2. Return: Upstream of terminal units.
 - 3. Exhaust: All
 - 4. Transfer: Less than 1" static pressure.

1.3 DEFINITIONS

- A. Conditioned Space: An area inside the building which is heated and/or cooled.
- B. Tempered Space: an area inside the building which is not directly heated or cooled, but is adjacent to a heated or cooled space with no insulation separating the two spaces (e.g., ceiling plenums).
- C. Untempered Space: an area inside the building which is not conditioned and is not tempered (e.g., attic spaces).

1.4 QUALITY ASSURANCE

- A. Duct and plenum construction, metal gauges, reinforcing, methods of supporting and hanging and other sheet metal work as called for shall be in accordance with the following standards:
 - 1. "SMACNA HVAC Duct Construction Standards", most recent Edition, by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- B. Unless noted otherwise, all ductwork shall be provided with pressure class and leakage class as indicated and scheduled on the plans. If pressure or seal class is not indicated, ductwork shall be provided to meet the pressure class based on the scheduled capacity of the equipment it is served by or connected to and with seal class A.

- C. NFPA Compliance: All liner and covering materials shall have maximum UL Flame Spread Index of 25, and maximum Smoke Developed Index of 50, and shall meet all requirements of NFPA 90A.

1.5 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Shop Drawings:
 - 1. Submit 1/4" per foot scale shop fabrication shop drawings.
 - a. Shop drawings shall include locations of all control devices, including dampers, airflow measuring stations, sensors, etc. Coordinate locations with the BAS Contractor prior to submitting shop drawings. Shop drawings shall include the BAS Contractor's submittal review stamp prior to submitting to the Design Professional for review.
 - 2. Submit shop drawings of elbows and fittings showing static pressure loss charted for air quantities involved in each.
- C. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation. Submit product data for each accessory/component for ducts/fittings including, but not limited to turning vanes, tie rods, sealants and balancing dampers.
- D. Certifications: Submit certifications or other data as necessary to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.6 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
 - 1. Operation and Maintenance Manual: Maintenance requirements.
 - a. Include approved Product Data and Shop Drawings.
 - 2. As-builts.

1.7 REGULATORY REQUIREMENTS

- A. National Fire Protection Association, NFPA 90A: Air Conditioning and Ventilating Systems.
- B. Underwriter's Laboratories, UL 181: Factory-Made Duct Materials and Air Duct Connections.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect shop-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling.
 - 1. Stored materials subject to rejection due to damage.
- B. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
- C. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All sheet metal work shall be constructed of prime quality re-squared tight coat galvanized steel, except where other type material is specified. Manufacturer's name and U.S. gauge number shall appear on each sheet.
- B. Duct Lining Materials
 - 1. Certain Teed
 - 2. Owens Corning Fiberglass
 - 3. Johns Manville
 - 4. PPG
 - 5. Knauf

2.2 LOW VELOCITY DUCTWORK

- A. General: Provide factory fabricated or shop fabricated duct and fittings.
- B. Materials:
 - 1. Galvanized sheet steel complying with ANSI/ASTM A527, lockforming quality, with ANSI/ASTM A525, G90 zinc coatings, mill phosphatized.
- C. Gauge: Comply with code requirements for minimum gauge thickness for various sizes.
- D. Fittings:
 - 1. Construct branches, bends, and elbows with centerline radius of not less than duct 1.0 times the width (diameter), where space conditions will not permit this radius or where indicated on drawings, square elbows with air turns shall be used.
 - 2. Slopes for transitions or other changes in dimension shall be minimum 1:3.

E. Seams:

1. Longitudinal seams shall be Pittsburgh Lock per SMACNA.
2. Lateral seams shall be standing.
3. Slip seams and sheet metal screws not permitted.

2.3 PLENUMS

- A. Plenums shall be fabricated of same material as duct connecting to plenum; shall be two metal gauges heavier than gauge of largest duct connecting to plenum.

2.4 DUCT SEALING – LOW VELOCITY

- A. All joints in low velocity duct work shall be sealed with Foster 32 14 or DuctMate ProSeal. Apply and install joint sealer per manufacturer's recommendations. In general, apply to male end of coupling and/or interior of female fitting. After connection, brush sealant over the assembled joint and screws with a 2" to 3" wide band. Sealant shall be allowed to set for 48 hours before any air pressure is put on system. All tie bars, bolts and rivets shall be sealed with the specified sealant. Sealant as manufactured by 3M No. 800 or United Sheet Metal will be considered equal.
- B. Alternate Sealing System:
1. Transverse duct joints may be made with the Ductmate System or an approved equal.
 2. The installation of the Ductmate System shall be in accordance with the manufacturer's printed instruction and installation manuals.
 3. The standard Ductmate System joint is the equivalent of a SMACNA "J" connection. The Ductmate JR System joint is the equivalent of a SMACNA "E" connection. Construction of the duct, such as gauge, reinforcing, etc. shall be as indicated in the addendum to the SMACNA manuals as provided by the manufacturer and as tested by Pittsburgh Testing Laboratory.
- C. Duct Sealing Requirements: SMACNA Seal Class A.

2.5 DUCT LINER

- A. Lining materials shall be Type 'A' Duct Liner, Certain Teed Toughgard or equivalent, one and one half (1 1/2) pounds per cubic foot density or equal.
- B. Unless specifically indicated to not be insulated, all ductwork and accessories shall be either lined or wrapped. Duct systems not listed or without a type or thickness indicated on the plans shall be insulated with 1-1/2" wrap.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight and quiet systems, capable of performing each indicated service.
 - 1. Install each run with minimum joints.
 - 2. Align ductwork accurately at connections and with internal surfaces smooth.
 - 3. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and prevent buckling and vibration without damage to insulation.
 - 4. Duct support systems shall be designed to support a minimum of four (4) times the calculated weight of the duct system.
- B. Ducts shall be installed following essentially lines indicated on drawings, install offsets, angles and transitions as may be required to avoid interferences with other work. Maintain full capacity of ducts at offsets, angles and transitions except where drawings indicate use of reducing or increasing transitions.
 - 1. General: Each duct section shall be rigidly supported from structure. Attach hangers to structure with expansion plugs, concrete inserts, beam clamps or other approved means. Rubber in shear isolators shall be installed in hangers for all ducts in equipment rooms, to prevent vibration transmission to the structure.
- C. Install hangers and supports in accordance with SMACNA Standards general locations:
 - 1. Install hangers close to transverse joints of main ducts and branches, clinch collar branch connections and the first branch elbows after nested splits.
 - 2. Locate hangers of duct penetrating walls or partitions as though the walls will contribute no support to the duct.
 - 3. Install hangers in pairs on exact opposite sides of duct.
 - 4. Maintain hanger spacing intervals less than, equal to, but not greater than the specified maximums.
 - 5. Install hangers at the midpoint of small and medium size horizontal vaned square elbows. On wide vaned square elbows, install additional hangers at maximum allowable intervals or less measured along the heel lines of the elbows.
 - 6. Provide a set of hangers at the midpoint of small and medium size horizontal radius elbows. Install one or more supplementary hangers, as necessary, along the inside and outside arcs of large radius elbows of any angle whenever the lengths of these arcs exceed the maximum hanger spacing length for that particular size duct.
 - 7. Provide at least one set of hangers for short duct branches 3 feet or less in length.
 - 8. Provide each duct riser with a minimum of two supports completely spanning the shaft opening at each floor. One pair of supports may be used to support more than one duct riser, provided that the strength of the supports is increased appropriately and proper additional supplementary steel is used at the extra risers.

9. Support duct risers, located between floors that are more than 15 feet high, at each floor and halfway points between floors. The distance between intermediate supports on very high floors should not exceed 12 feet. Intermediate hangers may be supported from an adjacent wall or hung by rods from supports on the floor above.
 10. Provide one or more sets of hangers for equipment in duct runs such as heating coils, heat pumps, etc., as recommended by their manufacturers.
 11. Hangers shall not be attached to metal roof deck.
- D. Locate duct hangers approximately:
1. 2 to 24 inches from flexible connections of fans.
 2. 2 to 24 inches from the outlets or flexible connects of VAV control units or mixing boxes.
 3. 12 to 36 inches from the main duct to the first hanger of long branch ducts.
 4. 2 to 12 inches from the ends of all branch ducts and linear diffuser plenums.
 5. 2 to 24 inches from fire damper breakaway joints.
 6. 0 inches to half the duct width plus 2 inches from the vertical centerline of the lower elbow of short vertical offsets made with vaned square elbows. The width refers to the dimension of the elbow in the plane of the turn.
 7. 0 inches to half the duct width plus 2 inches from the vertical centerline of the bottom and top elbows of vaned square elbow offsets over 8 feet high.
 8. One eighth of the arc in from the ends of bottom and top radius elbows of vertical offsets longer than 8 feet. Short vertical offsets require hangers at the bottom elbow. Likewise, sloping offsets need at least one set of hangers at their lower radius elbow.
 9. 6 to 12 inches from transverse joints of ducts whose lengths are the same as specified hanger intervals.
 10. 6 to 12 inches from one side of walls or partitions penetrated by ducts.
- E. Maximum permitted hanger spacing:
1. Ducts with areas up to 4 square feet may have their hangers spaced up to 8 feet apart.
 2. Ducts with areas 4.1 to 10 square feet may have their hangers spaced not more than 6 feet apart.
 3. Ducts with areas over 10 square feet may have their hangers located up to 4 feet apart.
- F. Provide and install locking manual volume dampers in all duct systems as required for controlling air volumes to trunk ducts, branch ducts, outlets and inlets. Provide and install additional volume dampers as required by Testing and Balancing Contractor for balancing of system.
- G. All connections shall be sealed, including but not limited to branch connections, spin-ins, taps, access doors, access panels and connections to equipment. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
- H. Duct sizes shown on drawings are net inside dimensions and sheet metal size shall be increased to allow for duct linings.

- I. Install as indicated on the drawings all duct mounted equipment as specified in other sections.
- J. Install eccentric reducers with tops of both duct sizes flush to maintain maximum ceiling space below ducts.
- K. Openings:
 - 1. Provide in ductwork to accommodate access doors, temperature control components and fire dampers.
 - 2. Install access panels for inspection and servicing of all duct mounted equipment including, but not limited to: reheat coils, sound attenuators, motorized dampers, airflow measuring stations, smoke and fire dampers. Access panels shall be sufficiently size for maintenance of items needing access in the duct and easily accessible.
 - 3. Provide pitot tube openings for testing of systems, complete with metal cap, with spring device or screw to ensure against air leakage.
 - 4. Where openings are provided in insulated ductwork, install insulation materials inside metal collar.
- L. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- M. Connections:
 - 1. Connect duct to equipment with flexible fabric, sheet metal clips, screws and washers.
 - 2. At each point where ducts pass through partitions, provide sleeve with space between duct and sleeve packed with insulation and sealed.
- N. Where ducts pass through fire-rated walls, partitions, floors, and ceilings, seal openings in accordance with Specification Section 230500 - Common Work Results for HVAC.

3.2 DUCT LINER APPLICATION

- A. Apply duct liner with coated or surface designed to be exposed facing the air stream and adhered with 100% coverage of fire retardant adhesive. When width exceeds 12" or height exceeds 24", additionally secure liner with mechanical fasteners spaced 12" maximum centers. Fasteners shall start within 3" of leading edge of traverse joints. Coat all exposed joints and edges of traverse joints with a fire retardant adhesive.
- B. Duct sizes shown on drawings are net inside dimensions and sheet metal size shall be increased to allow for duct lining.

3.3 ADJUSTING AND CLEANING

- A. Cleaning:
 - 1. Clean ductwork internally, as it is installed, of dust and debris.

2. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Temporary Closure:

1. At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation or that are on-site but not yet installed, provide temporary closure of polyethylene film or other covering until time connections are to be completed.

3.4 DUCTWORK APPLICATION SCHEDULE – LOW VELOCITY

<u>AIR SYSTEM</u>	<u>MATERIAL</u>
HVAC Supply, Return General Exhaust Transfer	Steel, Galvanized

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of duct accessories is indicated on drawings and by the requirements of this section.
- B. Types of duct accessories required for project include the following:
 - 1. Volume Dampers/Regulators
 - 2. Flexible Ducts
 - 3. Access Doors

1.3 QUALITY ASSURANCE

- A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) "Fire Damper and Heat Stop Guide".
- B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.
- C. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data: provide one submittal containing the following information:
 - 1. Manufacturer's technical information for each type of duct accessory, including dimensions, capacities, materials of construction, installation instructions, interfacing requirements with ductwork, and method of fastening or support where applicable.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products manufactured by one of the following:
 - 1. Flexible Ductwork
 - a. Semco
 - b. Wiremold
 - c. Thermaflex
 - d. Valuflex

2.2 MISCELLANEOUS

- A. Manual Volume Dampers:
 - 1. Rectangular duct width of 48" or smaller and height of 12" or smaller or all round ducts.
 - a. Damper shall be fabricated of same material as the duct, two metal gauges heavier than duct and hammered 1" all around.
 - b. Provide end bearings with gasket. Models listed are Young Regulator Co. Equals by Elgen are acceptable
 - 1) Round ducts 4" to 8" with 3/8" rod: Model 666-RD.
 - 2) Round ducts greater than 8" and all rectangular ducts with 3/8" rod: Model 666-FD.
 - 3) All round and rectangular ducts with 1/2" rod: Model 515A.
 - c. Blades and rods construction:
 - 1) Rectangular duct width of 12" or smaller: Damper blade shall be mounted on two 3/8" pins on the ends of the blade.
 - 2) Rectangular duct width greater than 12": Damper blade shall be mounted on continuous 1/2" rod.
 - 3) Round duct of 12" diameter or smaller: Damper blade shall be mounted on two 3/8" pins on the ends of the blade.
 - 4) Round duct diameters larger than 12": Damper blade shall be mounted on a continuous 1/2" rod.
 - d. Single blade dampers shall have locking quadrant regulators.

2. All other rectangular duct that fall outside the criteria above shall be opposed action multi-blade.
 - a. Damper frames are to be constructed of minimum 13-gauge.
 - b. Damper blade width shall not exceed 9 inches and the blade length shall not exceed 48 inches. Damper blades shall be of corrugated type construction.
 - c. Damper shall be constructed of the same material as the duct in which it will be installed.
 - d. Where damper shafts penetrate the damper housing, it shall be sealed while allowing the free movement of the shaft without breaking the seal.
 - e. Provide with shaft extension where duct will have exterior insulation applied.
 - f. Multi blade dampers shall have locking quadrant regulators.

B. Manual Volume Damper Regulators:

1. Accessible areas: Provide locking position regulator with gasket and handle. Below model numbers are based on Young Regulator Co. Equals by Elgen or Rossi are acceptable.
 - a. Model 403 for a 3/8" damper shaft on ductwork without external insulation.
 - b. Model 443B for a 3/8" damper shaft on ductwork with external insulation.
 - c. Model 404 for a 1/2" damper shaft on ductwork without external insulation.
 - d. Model 404B for a 1/2" damper shaft on ductwork with external insulation.
2. Inaccessible areas: Provide concealed manual volume damper regulators with BCW casing and wire and rack and pinion assembly. Damper shall be able to be operated when the damper and rack and pinion assembly are up to 50 ft apart. Young Regulator Co. Model 270-275 or equal by Elgen.

C. Backdraft Dampers

1. Counter-balanced backdraft damper Ruskin model CBD6 or equal.
 - a. Frame: Heavy duty 0.125" thick aluminum
 - b. Blades: 0.070 thick aluminum with extruded vinyl edge seals
 - c. Bearings: Zytel
 - d. Linkage: 0.125" thick aluminum tie bars
 - e. Counterbalance: Zinc plated bar mounted on blades with adjustability for job site final setting
 - f. Temperature: -40 deg F to 200 deg F
 - g. Back Pressure:
 - 1) 48" section width – up to 4" wc
 - 2) 36" section width – up to 8" wc
 - 3) 24" section width – up to 12" wc
 - 4) 12" section width – up to 16" wc
 - h. Operation: blades start to open at 0.01" wc and are fully open at 0.05" wc

D. Air Turns: Elgen "Air Tite" or equal shop fabricated.

E. Flexible Duct Connection:

1. Ventfabrics, Inc. Ventglas or equal.
2. Flexible neoprene or heavy glass fabric duct connector with minimum material thickness of 0.024" and weight of 30 oz/sq. yard.

3. Minimum temperature range shall be 30 to 200 deg F.
 4. The materials shall have a flame spread rating below 25 and smoke development rating below 50.
 5. The minimum static pressure rating shall be 10".
- F. Access Panels: Shall be of same material as ducts in which they are installed, fabricated of two thicknesses of not less than 24 gauge, with 1" thick rigid glass fiber filler. Provide sheet metal frame, air tight gasket and two thumb operated cam lock latches. Latches must be operable without the use of any tools.

2.3 FLEXIBLE DUCT – LOW VELOCITY

- A. Flexible duct shall be factory pre-insulated with a minimum R value of 4.0 ft²-F/BTU, consisting of vinyl coated spring steel wire helix bonded to vinyl coated fiberglass mesh screen, having one (1) inch nominal fiberglass insulation and vinyl impregnated closely woven fiberglass vapor barrier. Basis of Design: Semco, Type A1.
- B. Composite assembly shall meet Class I requirements of NFPA-90A and shall be UL listed for flame spread rating of not more than 25 and smoke developed rating of not more than 50. Assembly shall meet the requirements of UL-181 and bear the ADC seal of approval.
- C. Where flexible duct is allowed, it shall be connected to metal ducts, terminal units and diffusers with Panduit, Tylon or equal tool installed nylon clamps.
- D. Maximum length of flexible duct connections from metal duct to terminal units and grilles, registers and diffusers shall be not greater than 72". All duct turns greater than 45 deg. shall be rigid elbows.
- E. Wherever ductwork is routed exposed, flexible ductwork is not acceptable. All exposed ductwork to be rigid.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

- B. Install access panels for inspection and servicing of all duct mounted equipment including, but not limited to: reheat coils, motorized dampers, airflow measuring stations, fire dampers, smoke dampers, and combination fire/smoke dampers. Unless noted otherwise, access doors to be square and dimensions shall be 2" less than the duct dimension where they are installed, with a maximum size requirement of 24" x 24". Locate access doors (i.e. side or bottom of duct) where they provide the best access to duct equipment/accessory relative to surrounding piping, equipment, structure, etc.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.
- E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.
- F. Furnish General Contractor with layout and size of wall openings. Coordinate installation of louver with General Contractor. Make duct connections to louvers as shown on the plans.
- G. Install all manual dampers with damper in full open position.

END OF SECTION 233300

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SECTION 233600 – VARIABLE AIR VOLUME TERMINALS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 23 0010 - HVAC General Provisions are applicable to work required of this Section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary to install air terminal units as required by the drawings and this section.

1.3 TERMINAL UNITS

- A. Air Terminal units shall include the following:
 - 1. VAV Boxes

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data: provide one submittal containing the following information:
 - 1. Manufacturer's drawings and/or catalog cuts showing technical data necessary to evaluate the equipment, to include color charts, dimensions, wiring diagrams, performance data and other descriptive data necessary to describe fully the air terminal units.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.

1.6 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 01 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. VAV Boxes

- 1. Trane

2.2 VAV BOXES

- A. General: Ceiling mounted variable air volume supply air or exhaust control terminals for connection to single, medium pressure duct, central air systems, with heating coils (where scheduled) and air flow measuring station. Direct digital controls and actuation to be provided by DDC Controls Contractor.
- B. Casing: 22-gauge galvanized steel housing, mechanically sealed and gasketed. Provided with round stub inlet duct connection and S and drive outlet duct connection. Hanger holes to be provided on four corners for installation. Leak rate not greater than two percent at 0.5 inch wg. for sizes up through 14 inch and not greater than three percent for sizes 16 inch and above.
- C. Lining: Non-porous, rigid 4 lb. density fiberglass insulating material with an aluminum foil facing. All edges are sealed with metal endcaps and corner angles to prevent particles from entering air stream. The liner's integrity shall be maintained where the damper shaft penetrates the insulation by a flanged nylon bushing. Design basis is Price CFAF cleanroom aluminum foil system.
- D. Control Damper:
 - 1. Locate air volume damper assembly inside unit casing. Construct from extruded aluminum or 20 gauge galvanized steel components with peripheral gasket and solid steel shaft, pivoted in self-lubricating bearings.
 - 2. Air volume control damper shall be factory calibrated assembly consisting of damper and damper shaft extension for connection to externally mounted control actuator.
 - 3. Leakage rate not greater than 2% of nominal CFM at 1" 3 in. w.g. inlet static pressure when tested in accordance with ASHRAE 130.

- E. Air Flow Sensor: Eight point flow sensing ring capable of sensing true airflow to within +/- 10 percent regardless of inlet duct connection. Sensor includes pressure taps on inlet cone of air valve to provide the velocity signal for volume regulator and to measure airflow through the valve when used in conjunction with calibration chart provided on unit.
- F. Automatic Flow Controller: To be a thermostatically reset velocity controller which provides constant delivery air control within +/- 5 percent of rated flow down to 25 percent of unit rated cfm, independent of changes in system static pressure, with 1 1/2 diameters of straight duct at the unit inlet. Control to within +/- 10 percent to be obtained with any inlet duct connection. Factory calibrated, field adjustable setpoints shall be provided to set maximum and minimum cfm.
- G. Provide terminal unit with control enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units and make duct and piping connection as indicated on drawings. Multi-row coils shall be installed in counterflow arrangement relative to airflow.
- B. Install shut off cocks, balancing cocks, air vents, control valves and devices as required for complete installation.
- C. Controls: Install devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Contractor for power wiring.
 - 1. Verify that wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start up until wiring installation is acceptable to equipment installer.

END OF SECTION 233600

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SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide material, equipment, labor and supervision necessary for the installation of grilles, registers and diffusers as per the schedules on the drawings.

1.3 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data: provide one submittal for each type of device to be used containing the following information.
 - 1. Manufacturer's cut sheet indicating materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings. For diffusers, registers, and grille schedule: indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings
 - b. Include manufacturer's maintenance information.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. Carnes

2. Titus
3. Price
4. Greenheck
5. Krueger
6. Nailor
7. Tuttle & Bailey

2.2 DIFFUSERS REGISTERS AND GRILLES

- A. Diffusers, registers, and grilles shall be of the type and style as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall mounted grilles and registers plumb and level and flush to surface. Locations may be altered slightly, as acceptable to the Design Professional, so as to fit masonry portions of the structure.
- B. In grid panel type ceilings, lay in metal pan, acoustical, etc., grilles, registers and diffusers shall be located in the center of the panel.
- C. Coordinate locations of ceiling diffusers and registers with Design Professional's reflected ceiling plan. Where architectural features or other items conflict with installation, notify Design Professional for determination of final location.
- D. Adjust blow pattern as indicated on plans and as scheduled, prior to balancing.

END OF SECTION 233713

SECTION 237400 - PACKAGED OUTDOOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 230010 - HVAC General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of packaged outdoor HVAC equipment work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Provide installation of rooftop units furnished by owner.
- C. Refer to Division 26 sections for the following work; not work of this section.
 - 1. Power supply wiring from power source to power connection on packaged outdoor HVAC equipment. Include required electrical devices except where specified as furnished, or factory installed by manufacturer.
- D. Refer to other Division 23 sections for ductwork required external to rooftop heating cooling units for installation; not work of this section.

1.3 QUALITY ASSURANCE

- A. Warranty:
 - 1. Provide one year warranty on all installation aspects.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Layout drawings: provide shop drawing indicating location of rooftop units and how they relate to existing building elements (roof joists, existing RTUs etc)

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

1.6 COMMISSIONING

- A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 01 for detailed commissioning requirements.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle packaged outdoor HVAC equipment and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged packaged outdoor HVAC equipment or components; replace with new.
- B. Comply with manufacturer's rigging and installation instructions for unloading packaged outdoor HVAC equipment and moving them to final location.

PART 2 - PRODUCTS – Not Applicable

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which rooftop heating and cooling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF ROOFTOP HEATING AND COOLING UNITS

- A. General: Install rooftop heating and cooling units in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.
- B. Support: Install units on roof curb or curb adapter as indicated on the drawings, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations. Roof curbs and curb adapters furnished by owner.
- C. Controls: Install devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Contractor for power wiring only.
 - 1. Verify that wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start up until wiring installation is acceptable to equipment installer.

- D. Ductwork: Refer to Division 23, Section 233113 - Metal Ducts. Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection size.
- E. Gas Piping: Refer to Division 22, Section 221516 - Facility Natural Gas Piping. Connect gas piping to unit gas train with shutoff cock and drip leg.
- F. Start up rooftop heating and cooling units in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - 1. Balancing of unit systems is specified in Division 23, Section 230593 - Testing, Adjusting and Balancing for HVAC; not work of this section.
- G. Provide traps on condensate drains with a seal depth equal to unit total static pressure plus 1/2".

3.3 GROUNDINGS

- A. Provide positive equipment ground for rooftop heating and cooling unit components.

END OF SECTION 237400

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SECTION 260010 - ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. Work shall include furnishing of all systems, equipment and material specified in this division and as called for on the electrical drawings, to include supervision, operations, methods and labor for the fabrication, installation, start up and tests for the complete electrical installation.
- B. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft.
- C. All work shall be performed in a neat, professional manner in keeping with the highest standards of the craft.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. National Electrical Code
 - 2. National Fire Protection Association
 - 3. National Electrical Manufacturers Association
 - 4. Standards of Institute of Electrical and Electronic Engineers
 - 5. International Building Code
 - 6. Occupational Safety and Health Act
 - 7. Iowa Administrative Code
 - 8. NECA Standards
 - 9. Americans With Disabilities Act (ADA)
- B. All Contractors shall familiarize themselves with all codes and standards applicable to their work and shall notify Design Professional of any discrepancies between the design and applicable code requirements so that any conflicts can be resolved. Where two or more codes or standards are in conflict, that requiring the highest order of professionalism shall take precedence, but such questions shall be referred to Design Professional for final decision.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the local utility companies. He shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Meters for incoming services shall be selected based on the project requirements. Any questions concerning this shall be referred to Design Professional prior to bidding. Contractor shall provide the appropriate meter and associated materials if not furnished by the utility company.
- C. Secure all required permits and pay for all inspections, licenses and fees required in connection with the electrical work including State of Iowa Electrical Inspections. Contractor shall post all bonds and obtain all licenses required by the State, City, County and Utility.
- D. Contractor shall make all arrangements with each utility company and pay all service charges associated with new service.

1.5 ELECTRICAL DRAWINGS

- A. The electrical drawings indicate in general the building arrangement only. Contractor shall examine construction drawings to become familiar with the specific type of building construction, i.e. type of structural system, floors, walls, ceilings, room finishes and elevations.
- B. Drawings for the electrical work are in part diagrammatic, and are intended to convey the scope of the work and to indicate in general the location of equipment.
- C. Contractor shall layout their own work and shall be responsible for determining the exact locations for equipment and rough ins and the exact routing of conduits and raceway so as to best fit the layout of the work.
- D. Contractor shall take their own field measurements for verifying locations and dimensions; scaling of the drawings will not be sufficient for laying out the work.
- E. Because of the scale of the drawings, certain basic items such as couplings, pull or splice boxes may not be shown, but where such items are required by code or by other sections of the specifications or where they are required for proper installation of the work, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact locations of all existing services prior to beginning work in that area.
- B. Existing active services, i.e., water, gas, sewer, electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain.

- C. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- D. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to familiarize themselves with the conditions of the site which will affect their work and shall verify points of connection with utilities, routing of outside conduit to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate their work with the schedule of the General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building. The Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.
- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications or between the requirements set forth for the various contractors shall be called to the attention of the Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required, and that the Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by the Design Professional and their decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting, plaster, etc., until the project is substantially completed. Damage from rust, paint, scratches, etc., shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the Painting Contractor, but this shall not relieve Contractor of the responsibility for checking to assure that adequate protection is being provided. Refer to Division 09 for painting protection.

- F. Where the final installation or connection of equipment in the building requires the contractor to work in areas previously finished by the General Contractor, the Electrical Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Electrical Contractor shall arrange with the General Contractor for patching and refinishing of such areas which may be damaged in this respect.

1.9 OPENINGS, CUTTING AND PATCHING

- A. Conduits and wireways passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and conduits, sleeves and/or wireways, shall be sealed with UL listed intumescent fire barrier material equivalent to rating of wall/floor. Where conduits, sleeves and/or wireways pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk
- B. New structure:
 - 1. Contractor will coordinate the placing of openings and lintels in the new structure as required for the installation of the electrical work with the General Contractor.
 - 2. Contractor shall furnish to General Contractor the accurate locations and sizes for required openings, but this shall not relieve Contractor of the responsibility of checking to assure that proper size openings are provided. When additional cutting and patching is required due to Contractor's failure to coordinate this work, Contractor shall make arrangements for the cutting, patching, and painting required.
- C. Existing Structure:
 - 1. Contractor shall provide cutting, lintels and patching, and patch painting in the existing structure, as required for the installation of their work, and shall furnish lintels and supports as required for openings.
 - 2. Cutting of structural support members will not be permitted without prior approval of the Design Professional. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings.
 - 3. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.10 EXCAVATING AND BACKFILLING

- A. Contractor shall do all excavating necessary for light pole bases, underground wiring, conduit and duct banks, and shall backfill trenches and excavations after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way, except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the conduit. Excavation shall be kept free from water by pumping if necessary.

- B. Backfill about the structures shall be placed, when practicable as the work of construction progresses. Backfilling on or against concrete work shall be done only when directed. Backfilling of trenches shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six (6) inches above the existing grades. In backfilling trenches, selected material shall be compacted firmly around and to a depth of not less than six (6) inches over the top of work in trench. All fill and backfill and rough grading shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades. All fill and backfill shall be sand or pit run sand/gravel graded from 1" size downward.

1.11 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable U.S.A. manufacturer regularly engaged in the manufacture of the specified item unless authorized in writing by Design Professional. Where more than one unit is required of the same system, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items when required shall be furnished as part of the equipment, whether or not specifically called for.

1.12 SUBMITTALS

- A. Contractor shall furnish, to the Design Professional, complete sets of shop drawings and other submittal data. Contractor shall review and sign shop drawings before submittal. Refer to Division 01 specifications for additional requirements.
- B. Shop drawings shall be bound into sets and cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal or unbound submittals will be rejected.
- C. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- D. After award of contract, the contractor shall provide a completed submittal schedule including dates that the submittals will be to the Design Professional for review.
- E. Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- F. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to Design Professional. Refer to Division 01 specifications for additional information.
- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three ring hard-backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
ELECTRICAL SYSTEMS

(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME AND ADDRESS OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Use plastic tab indexes for sections of manual. Each section shall contain the following information for equipment furnished under this contract:
 - 1. Equipment and system warranties and guarantees.
 - 2. Installation instructions.
 - 3. Operating instructions.
 - 4. Maintenance instructions.
 - 5. Spare parts identification and ordering list.
 - 6. Local service organization, address, contact and phone number.
 - 7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.
- D. Items to be included shall be those listed in shop drawing section.

1.14 ELECTRICAL TESTING

- A. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner.
- B. Contractor shall test the electrical grounding system resistance in accordance with Specification Section 260526 – Grounding and Bonding for Electrical Systems and submit a report to Design Professional stating the results.

1.15 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the electrical installation, the Contractor shall demonstrate to the Owner, or their designated representatives, all essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems. Owner instruction shall be provided for the following systems.
 - 1. Provide adequate notice to Owner as to when instruction will be conducted so appropriate personnel can be present.
 - 2. Prepare the instruction format for a minimum of four Owner Representatives.
- B. System training:
 - 1. These sessions shall include hands-on demonstrations of system wide start-up, operation in all possible modes, shut-down and emergency procedures.
 - 2. System training shall include, but not be limited to, distribution equipment and branch panel locations, feeder sources, system start-up/shut-down/emergency procedures.
- C. Contractor shall submit to the Design Professional a certificate signed by the Owner stating the date, time, and persons instructed and that the instruction has been completed to the Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that the contractor has demonstrated the hereafter listed systems to the Owner's representatives in accordance with the Contract documents and that the instruction has been completed to the Owner's satisfaction.

A. Project:

B. System(s):

C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

E. Acknowledgement of demonstration:

Contractor's Representative:

signature

date

Owner's Representative:

signature

date

1.16 SUBSTITUTIONS

- A. To obtain approval to use unspecified equipment, Bidding Contractors (not equipment supplier, manufacturers, etc.) shall submit written requests to Design Professional at least 10 days prior to bid due date. Requests shall clearly describe the equipment for which approval is being requested. Include all data necessary to demonstrate that equipment's capacities, features and performance are equivalent between specified equipment and equipment for which approval is being requested. If the equipment is acceptable, Design Professional will approve it in an addendum. Design Professional will, under no circumstances, be required to prove that an item proposed for substitution is or is not of equal quality to the specified item.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.17 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer's type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plan schedules are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers, who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of the Contractor and/or the manufacturer.
 - 1. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions, operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
 - 2. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.18 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.
 - b. The entire Electrical system, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 26 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.19 CHANGES IN THE WORK

- A. Refer to Divisions 00 and 01.

1.20 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non hazardous and ready for normal use by the Owner.
- B. When all the electrical work is complete Contractor shall thoroughly clean all material and equipment installed as a part of this contract and leave all equipment and material in new condition.
- C. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

1.21 CLEANING

- A. Prior to assembly of electrical equipment, all loose dirt, scale, oil, and other foreign matter on internal and exterior surfaces shall be removed by means consistent with good electrical practices.
- B. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. Name plates, ratings, instruction plates, etc., shall not be obscured by paint, insulation, or placement of units.
- C. Electrical equipment shall be thoroughly cleaned on the interior and exterior of equipment. This includes, but is not limited to: removal of wiring trimmings within electrical panels and dirt/debris from activation boxes.
- D. All light fixtures shall be wiped clean with all fingerprints and dust removed.

1.22 TEMPORARY UTILITIES

- A. Refer to Specification Division 1 for specific requirements concerning temporary utilities.

END OF SECTION 260010

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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the following:
 - 1. Demolition.
 - 2. Sleeves
 - 3. Access Doors
 - 4. Equipment Pads

PART 2 - PRODUCTS

2.1 DEMOLITION MATERIALS

- A. All materials removed shall be the property of the removing contractor and shall be removed from the site unless otherwise specified.

2.2 SLEEVES FOR RACEWAY PENETRATIONS

- A. Sleeves passing through non load bearing walls and partitions shall be galvanized sheet steel with lock seam joints of minimum gauges as follows:
 - 1. For raceway 2 1/2" and smaller 24 gauge
 - 2. For raceway 3" to 6" 22 gauge
- B. Sleeves passing through load bearing walls, concrete beams, fireproof walls, foundations, footings and waterproof floors shall be Schedule 40 steel or cast iron.
- C. Sleeves are not required in masonry walls which are core drilled or walls of drywall construction, except where partition is a firestop, smokestop, or side of air plenum.
- D. Sleeves for penetrations in fire rated walls shall be in compliance with the specific firestop system installed.

- E. In finished areas where raceway is exposed, sleeves shall be terminated flush with walls, partitions and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water and fill space between sleeves and raceway with graphite packing and caulking compound.
- F. Sleeves passing through membrane waterproofing or lead safe shall be provided with flashing, furnished and installed by General Contractor, extending 12" beyond sleeve in all directions; flashing shall be secured and sealed to membrane or lead safe and shall be sealed to sleeve and caulked watertight. Sleeves passing through roof shall be installed in same manner except sleeves shall extend to 6" above roof.
- G. For exterior walls below grade, penetrations shall be watertight. Penetrations shall be sealed with modular mechanical rubber links tightened with bolts (Link-Seal or equal). New construction shall use water-tight sleeves approved by the sealing assembly manufacturer. Waterproofing of penetrations in exterior walls shall be coordinated with the waterproofing contractor.
- H. Refer to division 27 and 28 for sleeve requirements related to low-voltage systems.

2.3 ACCESS DOORS

- A. When Electrical Contractor provides any equipment, junction boxes, or pull boxes requiring access which will be concealed by non-accessible architectural construction, Electrical Contractor shall provide a flush access door. The access door shall be equal to a Karp DSC-214M Universal access door for non-rated construction or KRP-150FR for fire rated construction. Other approved manufacturers include Nystrom, Acudor, and Access Panel Solutions, with model applicable to the specific construction involved.
- B. Access doors in fire rated construction shall be fire rated and have U.L. label. Refer to Architectural/General Construction plans for fire ratings.
- C. Construction
 - 1. Door and trim shall be 13 gauge steel, frames shall be 16 gauge steel.
 - 2. Trim shall be of one piece construction.
 - 3. Finish shall be prime coat of rust inhibitive baked grey enamel.
 - 4. Hinges shall be concealed, offset, floating hinge.
 - 5. Locks shall be flush, screwdriver operated with stainless steel cam-and-studs.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. General
 - 1. Demolition shall be accomplished by the proper tools and equipment for the work to be removed. Personnel shall be experienced and qualified in the type of work to be performed.

B. Examination

1. Verify field measurements and circuiting arrangements are as shown on Drawings.
2. Verify that abandoned wiring and equipment serve only abandoned facilities.
3. Demolition Drawings are based on casual field observation. Report discrepancies to Owner before disturbing existing installation.

C. Preparation

1. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
2. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
3. Existing Electrical Services: Maintain existing system in service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
4. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
5. Existing Telecommunications Systems: Maintain existing systems in service. Disable systems only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system.

D. Demolition of Existing Electrical Work

1. Demolish and extend existing electrical work under provisions of this Section.
2. Remove, relocate, and extend existing installations to accommodate new construction. Extend existing installations using materials and methods as specified.
3. Remove abandoned wiring to source of supply.
4. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
5. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
6. Disconnect and remove abandoned panelboards and distribution equipment.
7. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
8. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
9. Repair adjacent construction and finishes damaged during demolition and extension work.
10. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
11. Clean and repair existing materials and equipment which remain or are to be reused.

E. Fluorescent Lamp and Ballast Disposal

1. Unless noted otherwise, all existing fluorescent and HID lamps and ballasts within light fixtures to be removed shall be assumed to contain mercury and PCB's respectively. These items shall be disposed of in accordance with all federal, state and local codes and ordinances. These items are required to be disposed of by a mercury and PCB Disposal Contractor, who shall be a subcontractor to Electrical Contractor. This Disposal Contractor shall have all local, state, and federal authorization for handling, transporting, and processing these materials. Disposal Contractor shall have pollution insurance and shall generate a Certificate of Disposal.
2. Unless noted otherwise, all existing fluorescent lamps and ballasts within light fixtures to be removed shall be assumed to contain mercury and PCB's respectively. The Contractor shall separate and sort all lamps and ballasts from light fixtures that are demolished. The Owner will provide storage (bins or containers) on the job site for lamps and ballasts. The Contractor shall coordinate with the Owner for removal of these stored lamps and ballasts. It shall be the Contractor's responsibility to receive the storage containers at an exterior building location and transport to the project work area. It shall be the Contractor's responsibility to coordinate pickup of these containers and transport them to an exterior building location for the Owner to dispose and recycle.

F. Work by Others

1. Unless specifically noted under other contracts, Electrical Contractor shall assume all required work shall be included. In general, the following will be performed by others:
 - a. General Contractor will remove any bases, floor fill, wall work and footings; neatly patch, match, complete and finish all affected surfaces.
 - b. Mechanical Contractor will disconnect all mechanical services and remove pipe back to behind finish surfaces, close and cap ends of pipe.

G. Owner's Right of Salvage

1. Owner may designate and have salvage rights to any material herein demolished by the Contractor.

3.2 SLEEVES

- A. Install sleeves for all piping passing through floors, roof, walls, concrete beams and foundations as required by this section.

3.3 ACCESS DOORS

- A. Install access doors per manufacturer's recommendations.

3.4 CONCRETE EQUIPMENT PADS

- A. Provide equipment housekeeping pads for all floor mounted equipment. Anchor equipment to concrete equipment pads according to equipment manufacturer's recommendations.
1. Construct concrete bases of dimensions indicated or as required to be 4 inches larger in both directions than supported unit. Pads to be a minimum of 3 1/2" in height unless noted otherwise.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts according to manufacturer's recommendations and to elevations required for proper attachment to supported equipment.
 6. Use 3000-psi compressive strength concrete with #3 rebar 12" O.C.
 7. Pad edges are to be painted yellow. Refer to Division 9.

END OF SECTION 260500

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all material, tools, labor, and supervision necessary to install all wiring systems.
- B. This section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating, if required, shall be as specified in other sections or called for on the drawings.

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wire, cable, and connectors.
- B. UL Compliance: Comply with UL standards pertaining to wire, cable, and connectors.
- C. UL Labels: Provide electrical wires, cables and connectors which have been UL listed and labeled.
- D. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of wire and cable.
- E. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of wire and cable.
- F. The materials used for wiring systems shall be the products of a manufacturer regularly engaged in the manufacturing of the specified material.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's technical product data for each product specified.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

- A. All wire and cable for power, lighting, control, and signal circuits shall have copper conductors of not less than 98% conductivity and shall be insulated to 600 V. Conductor sizes #12 AWG and smaller shall be solid, conductor sizes #10 AWG and larger shall be stranded.
- B. Minimum size conductors shall be #12 AWG for power and lighting.
- C. Type of wire and cable for various applications shall be as follows:
 - 1. Type THHN/THWN-2, or XHHW-2 (90 deg. C) use for branch circuits, panel and equipment feeders in dry locations.
 - 2. Type XHHW-2 (90 deg. C) use for branch circuits, panel and equipment feeders located underground and in wet and dry locations.
 - 3. 2-Hour Fire Rated Cable System with FHIT listing. UL 2196 listed for horizontal and vertical installations.
 - a. Pentair System 1850 Type MI mineral insulated cable.
 - b. Omni Cable VITALink Type MC 2-hour rated power cable.
 - c. RHW-2 based cable systems are not acceptable.
 - d. Provide all proprietary terminations and components for a complete listed system.
 - 4. Type UF use where permitted by other sections or by the drawings for underground burial branch circuits.
 - 5. For all vibration type installations (i.e. motors, etc.), provide stranded type conductors.

2.2 CONDUCTOR COLOR CODING

- A. Wiring systems shall be color coded. Conductor insulation shall be colored in sizes up through #8 AWG. Conductors #6 AWG and larger shall be colored or have black insulation and shall be phase color coded with one half inch band of colored tape at all junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution. When necessary to use tape, use colored tape on black wire. Do not use colored tape on colored wire.

	120/208V - Wye	277/480V - Wye
Phase 'A' Conductor	Black	Brown
Phase 'B' Conductor	Red	Orange
Phase 'C' Conductor	Blue	Yellow
Neutral (Grounded) Conductor	White*	Grey*
Equipment Grounding Conductor	Green	Green
Isolated Grounding Conductor	Green w/Yellow Stripe	Green w/Yellow Stripe

* For branch circuits with non-shared neutral conductors, provide colored tracer to match associated phase conductor. Tracers shall be Black, Red, Blue, Brown, Orange, or Yellow.

** Use red and black for phases which are 120V to neutral. Use orange for "wild leg".

2.3 CONNECTORS

- A. Vinyl Insulated Spring Twist-on Wire Connectors.
1. Dry Locations. 600V rated, UL 486C listed, Ideal Industries 451/452/454 or equal by 3M or Thomas and Betts. Use for #8 and smaller.
 2. Wet locations. 600V rated, UL 485D listed with pre-filled silicone sealant. Ideal Industries 61/62/63 series or equal by 3M or Thomas and Betts. Use for #8 and smaller. To be used for all above ground splices in exterior locations and interior wet locations.
 3. Underground locations. 600V rated, UL 485D listed for direct burial with pre-filled silicone sealant. Ideal Industries 60/64/66 series or equal buy 3M or Thomas and Betts. Use for #8 and smaller. To be used for all below ground and in-slab locations.
- B. Push-in Wire Connectors.
1. Dry Locations. 600V rated, UL 486C listed, Ideal Industries 32/33/34 or equal by Wago, 3M or Thomas and Betts. Use for #10 and smaller.
- C. Conductor Taps and Splices.
1. Dry Locations. 600V rated, UL 486A/B listed, insulated mechanical termination. IlSCO ClearTap PCT or equal by Burndy. Use for #6 and larger.

2. Wet and Underground Locations. 600V rated, UL 486D listed, watertight mechanical termination suitable for direct burial in earth. IIsco SafetySub PDSS or equal by Burndy or 3M. Use for #6 and larger.
3. Insulation piercing taps are not allowed.
4. Split bolt connectors and splices are not allowed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Wire shall not be installed in the conduit system until the building is enclosed and masonry work is completed.
- B. Conduit shall be swabbed free of moisture and debris prior to pulling in wiring. Pull mouse through conduits prior to pulling conductors.

3.2 INSTALLATION

- A. All cable for major feeders shall be continuous from origin to termination, unless otherwise indicated.
- B. Branch circuit conductor sizes shall be increased to maintain a maximum 3% voltage drop.
 1. 120V, 20A homeruns shall be sized as follows based on one-way circuit length:
 - a. 0-80': #12 AWG
 - b. 81'-140': #10 AWG
 - c. 141'- 210': #8 AWG
 - d. 211' and over: #6 AWG
 2. 277V, 20A homeruns shall be sized as follows based on the one-way circuit length:
 - a. 0-200': #12 AWG
 - b. 201'-300': #10 AWG
 - c. 301' and over: #8 AWG
- C. Conductors for emergency power systems shall be kept in entirely independent of all other wiring and equipment. Emergency system wiring shall not occupy the same raceway, wireway or junction box,
- D. Conductors for critical branch, life safety branch, equipment branch and normal shall be kept entirely independent of one another and all other wiring and equipment. Wiring for these systems shall not occupy the same raceway, wireway or junction box,
- E. Conductors for 208V and 480V systems shall be installed in separate raceway systems.
- F. Conduit fill: Branch circuit fill shall be limited to 3 grounded, 3 ungrounded, and 1 equipment grounding conductor.
- G. Splices shall be made only in accessible junction boxes or handholes.

- H. All power feeder cable shall be pulled with the use of approved pulling compound or powder. Compound must not deteriorate conductor or insulation.
- I. If conductor insulation is damaged during installation, replace entire conductor.
- J. Use pulling means, including fish tape, cable or rope which cannot damage raceway.
- K. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members and follow surface contours, where possible.
- L. Keep branch circuit conductor splices to a minimum.
- M. The continuity of circuit conductors shall not be dependent on service connections such as lamp holders, receptacles, etc., where the removal of such devices would interrupt the continuity.
- N. Provide separate green equipment ground conductor throughout entire electrical system.
- O. Isolated ground conductors shall be kept isolated from the equipment grounding system from the outlet back to where the system is derived.
- P. All branch circuits shall have dedicated neutrals.
- Q. Install 2-hour rated cable systems in strict accordance with the manufacturer's instructions and the UL Listing.

3.3 FIELD QUALITY CONTROL

- A. Prior to energizing system, test cable and wire for continuity of circuitry, and for short circuits. Correct malfunctions when detected.
- B. After wire terminations are complete, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and shall comply with NEC.
- B. Applications of grounding work in this section include the following:
 - 1. Metal water piping.
 - 2. Metal structures.
 - 3. Enclosures.
 - 4. Equipment.
- C. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- B. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data: provide one submittal containing the following information:
 - 1. Submittal data for equipment, cabling, and hardware shall consist of catalog cuts showing technical data necessary to evaluate the materials with specific item designated by arrow or by being highlighted.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.

PART 2 - PRODUCTS

2.1 GROUNDING SYSTEMS

- 1. All components shall be listed under ANSI/UL 467 – “Grounding and bonding Equipment”.
 - 2. Raceways: Provide raceways, and electrical boxes and fittings complying with Division 26, Section 26 0533 – Raceway and Boxes for Electrical Systems.
 - 3. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- B. Connectors
- 1. Lugs: Grounding and bonding conductors shall terminate in two-hole, long barrel irreversible compression lugs, Burndy YGA series or equal by Blackburn, Ilasco, Erico, Harger or Anderson. All connectors shall be UL476 listed.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL GROUNDING

- A. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.
- C. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

- D. Protect ground conductors from physical and environmental damage. Wherever possible, and where indicated, grounding electrode and bonding conductors shall be enclosed in a non-metallic raceway. Where ground conductors are subject to physical damage, install in galvanized rigid steel conduit with grounding bushings on each end. Locate exposed conductors which must extend from a concrete surface as close as possible to a corner. Where conductors are required to be exposed, as in the connection to the main ground bus, support ground conductors by corrosion resistant metallic hardware at 4-foot intervals or less.
- E. Provide separate green ground conductor throughout entire electrical system sized as required by the NEC.
- F. Conduit Grounding
 - 1. Bond all metallic conduit systems together to provide a continuous electrical ground path. Bond metallic conduits to other conduit components using insulated ground bushings when required. Connect ground bushings to the grounding system using conductors sized in compliance with NEC.
 - 2. Provide ground conductors in non-metallic conduits in accordance with the NEC.
- G. All portions of the metal building structure that are not electrically continuous shall be bonded to the service entrance grounding electrode system.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide materials, labor and supervision as necessary to provide hangers and supports for conduit, fixtures and equipment.

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.
- B. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA Std. Pub. No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies".
- C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- D. UL Compliance: Provide electrical components which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. Manufacturer: Subject to compliance with requirements, provide channel systems of one of the following:
 - 1. B Line Systems, Inc.
 - 2. Thomas & Betts, Superstrut
 - 3. Unistrut Div.; Tyco International
 - 4. Globestrut
- B. General: Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. Where more than one type of device meets indicated requirements, selection is Installer's option.

- C. Conduit Cable Supports: Provide cable supports with insulating wedging plug for non armored type electrical cables in risers; construct for rigid metal conduit; type wire as indicated; construct body of malleable iron casting with hot dip galvanized finish.
- D. U Channel Strut Systems: Provide U channel strut system for supporting electrical equipment, 16 gauge minimum, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface.
 - 1. Metallic Coatings:
 - a. Hot-dip galvanized after fabrication. Conform to ASTM A1011 SS GR 33, Finish conform to ASTM A123
 - b. Pre galvanized conform to ASTM A653 SS GR 33, G90.
 - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating. Conform to ASTM A1011 SS GR 33, E-Coat finish.
 - 3. Channel Dimensions: Selected for applicable load criteria.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Conduit hangers and support devices shall be approved type for the method of supporting required. Size supports as necessary per manufacturer's recommendations for the weight being supported. All hangers and supports shall have galvanized finish or other approved corrosion resistance finish. In general, hangers and supports shall be as follows:
 - 1. Where single or multiple run of conduit is routed on surface of structure; use conduit clamps mounted on U channel strut so as to maintain not less than 1" clearance between conduit and structure.
 - 2. Where single run of conduit is suspended from overhead; use split ring conduit clamp suspended by 3/8" steel drop rod.
 - 3. Where multiple parallel runs of conduit are suspended from overhead; use split ring conduit clamps uniformly spaced and supported on trapeze hangers fabricated of U channel strut, suspended by not less than two steel drop rods.
 - 4. Where circuit voltage is above 600 volts, conduit clamps shall be provided with insulating bushings of dielectric strength as required.
 - 5. Where conduit is buried in concrete floor topping; anchor conduit to structural floor with one-hole jiffy clamps.
 - 6. Maximum hanger and support spacing shall be in accordance with NEC.

D. Hangers and supports shall be anchored to structure as follows:

1. Hangers and supports anchored to poured concrete, use malleable iron or steel concrete inserts attached to concrete forms.
2. Hangers or supports anchored to precast concrete, use self drilling expansion shields. Expansion shields may be used where concrete inserts have been missed or additional support is required in poured concrete.
3. Hanger or supports anchored to structural steel, use beam clamps and/or steel channels as required by structural system.
4. Hangers or supports anchored to metal deck, use spring clips or approved welding pins. Maximum permissible load on each hanger shall not exceed 50 pounds.
5. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls.
6. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

E. The following is not permitted:

1. Attaching supports and hangers to piping, ductwork, mechanical equipment, conduit, ceiling tiles, ceiling support wires, or the like.
2. Use of powder-actuated anchors.
3. Drilling of structural steel members.

F. Fixtures on plastered or acoustical ceilings shall not be supported directly on ceiling tile. Provide metal bar hangers or U channel strut attached to ceiling supports.

G. Where disconnect switches and panels cannot be mounted on wall, provide support racks fabricated of structural steel or U channel strut.

H. U Channel Strut Application

1. Interior dry locations:
 - a. PVC, Polyurethane or polyester coating.
 - b. Pre galvanized steel.
2. Exterior and wet locations:
 - a. Hot dipped galvanized steel.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all materials, tools labor and supervision necessary to fabricate and install complete conduit systems.
- B. Conduit systems shall be provided for all wiring, except where the drawings or other sections of the specifications indicate that certain wiring may be installed in cable trays, surface raceway, underfloor raceway, wireways and/or auxiliary gutters.
- C. Types of raceways in this section include the following:
 - 1. Galvanized Rigid Steel (GRS) conduit
 - 2. PVC Coated Galvanized Rigid Steel conduit
 - 3. Rigid Aluminum Conduit (RAC)
 - 4. Intermediate Metal Conduit (IMC)
 - 5. Electrical Metallic Tubing (EMT)
 - 6. Flexible Metal Conduit (FMC)
 - 7. Liquidtight Flexible Metal Conduit (LFMC)
 - 8. Rigid Polyvinyl Chloride (PVC) conduit
 - 9. Surface metal raceways.
- D. Refer to 26 0553 Identification for Electrical Systems for required factory colored conduit requirements.
- E. Contractor shall furnish all material, tools, labor and supervision necessary to install electrical boxes and fittings as required by drawings and specifications.
- F. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet boxes.
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Wireways
 - 5. Activation boxes
 - 6. Floor and wall ducts
 - 7. Handholes

1.3 QUALITY ASSURANCE

- A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL listed and labeled.
- C. NEC Compliance: Comply with requirements as applicable to the construction and installation of raceway systems.
- D. The materials used in the fabrication of the raceway system shall be products of a manufacturer regularly engaged in the manufacturing of the specified material.
- E. NEC compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- F. UL Compliance: Provide electrical boxes and fittings which have been UL listed and labeled.
- G. ANSI/NEMA Standards Compliance: Comply with ANSI C 134.1 (NEMA Standards Pub No. OS 1) as applicable to sheet steel outlet boxes, covers and box supports.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Provide one submittal containing the following information:
 - 1. Raceway Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway listed below. Include data substantiating that materials comply with requirements for the following:
 - a. Raceway
 - b. MC Cable
 - c. Surface Metal Raceway
 - 2. Activation Box Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations for each type of activation box required. Include data substantiating that units comply with requirements.
 - 3. In-Ground Handhole Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations for each type of handhole required. Include data substantiating that units comply with requirements.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. General: Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways. Conduit shall be used where concealed in permanent wall construction or in ceiling plenums. See 260553 for color conduit requirements.
- B. Galvanized Rigid Steel Conduit (GRS).

Full weight, threaded, rigid steel conduit, galvanized inside and out by hot dip or electro galvanized process. Additional protection by electrostatically applied baked coating. Thread protective caps and couplings. Product shall conform to UL-6 and ANSI C80.1.

 - 1. Fittings (couplings, connectors and bushings): NEMA FB 1, UL 514B; steel, threaded connectors with double locknuts and insulating bushings. Threadless fittings including set screw and compression/gland are not permitted.
 - 2. Connector fittings over 2" shall have a grounding bushing.
- C. Intermediate Metal Conduit (IMC):
 - 1. Product shall conform to UL-1242 and ANSI C80.6.
 - 2. Fittings (couplings, connectors and bushings): NEMA FB 1, UL 514B; steel, threaded connectors with double locknuts and insulating bushings. Threadless fittings including set screw and compression/gland are not permitted.
 - 3. Fittings over 2" shall have a grounding bushing.
- D. Electrical Metallic Tubing (EMT):
 - 1. Thin wall, electrically welded cold rolled steel conduit, galvanized inside and out by electro galvanized process. Baked clear elastic enamel coating in and out. Product shall conform to UL-797 and ANSI C80.3.
 - 2. Fittings (couplings, conduit bodies, and connectors):
 - a. NEMA FB I, UL 514B; steel, watertight gland compression type connectors with double locknuts and insulated throat.
 - b. Conduit bodies cover: stamped steel, with stainless steel screws and neoprene gaskets.
 - c. Indenter, drive-on, die-cast or pressure cast fittings are not permitted.
 - d. Fittings over 2" shall have grounding bushings.

E. Flexible Metal Conduit (FMC):

1. Formed of one continuous length of spirally wound electro galvanized steel strip. Product shall conform to ANSI/UL-1 for Flexible Metal Conduit.
2. Fittings: NEMA FB I, UL 514B; 3/4" – 2" trade size: Die-Cast Zinc; Above 2" trade size: Zinc-Plated Malleable Iron. Insulated throat.

F. Liquidtight Flexible Metal Conduit (LFMC):

1. Formed of one continuous length of spirally wound steel strip, with water and oil tight neoprene jacket. Product shall conform to ANSI/UL-360 for Liquidtight Flexible Steel Conduit.
2. Fittings: NEMA FB 1, UL 514B; steel. Insulated throat.

G. Rigid Polyvinyl Chloride (PVC) Conduit:

1. Conduit shall be composed of Polyvinyl Chloride and shall conform to NEMA TC-2, and UL-651. Schedule 40 and 80 as specified in Part 3.
2. Fittings: NEMA TC 3, UL 651
3. Conduit, fittings, and cement shall be produced by the same manufacturer.

2.2 SURFACE METAL RACEWAY

- A. Provide surface metal raceways of sizes and channels indicated on plans and constructed of steel or aluminum with covers. Finish with manufacturer's standard baked on enamel paint or exposed metal as scheduled on drawings.
- B. Provide all components including raceway, adaptors, low-voltage dividers, boxes, and fittings for a complete installation.
 1. Manufacturer: Subject to compliance with requirements, the following manufacturers are acceptable:
 - a. Wiremold (basis of design)
 - b. Hubbell

2.3 WALL OUTLET BOXES

- A. General: Boxes shall be Racor, Steel City, Appleton or equal, catalog numbers based on Racor, unless otherwise indicated. In general, the type of boxes shall be as follows:
 1. In Stud Walls: For single outlet use 4" square by 2-1/8" deep box. Boxes to be provided with raised covers of depth as required for thickness of wall materials.
 - a. Boxes on the opposite sides of walls shall be staggered in separate stud cavities for sound and fire rated walls.
 2. In Masonry and Poured Concrete Walls: Use 3 3/4" high by 2 1/2" and/or 3 1/2" deep masonry boxes #691 through #694 and/or #695 through #699.
 3. Back-to-back or through-wall type boxes shall not be used.
 4. Surface Mounted Wall Outlets for conduit: Use 4" square by 1 1/2" deep box #192 with raised cover.

5. Surface Mounted Wall Outlets for surface metal raceway: Use single gang boxes 1-1/2" deep Wiremold #V57xx series.
6. Suspended Ceiling: Use octagon boxes, depth as required for application, securely fastened to structure.
7. Poured Concrete Ceiling Slabs: Use octagon concrete rings with back plates.
8. Outlets Installed Outdoors or in Wet Locations: Use Bell Product 53XX Series outlet box.

2.4 ACTIVATION BOXES

- A. Activation Boxes: Provide boxes as scheduled on the drawings.
- B. Activation boxes shall be provided with barriers to separate high and low potential voltages.
- C. Activation box shall maintain the fire rating of the floor or wall in which it is installed.
- D. Activation boxes shall be complete with necessary gaskets, plates, spacers, mud caps, covers, fasteners, brackets and ancillary components appropriate for their installation. Follow the manufacturer's specific written instructions for each type of installation.
- E. For wall activation boxes, coordinate elevation with other trades such that the box is concealed behind the wall mounted display and does not interfere with the mounting system of the monitor.
- F. For wall and floor activation boxes, coordinate exact placement with Architectural details prior to rough-in; dimensions shall not be scaled from electrical drawings.
- G. Wall and floor activation boxes shall maintain the fire rating of the wall or floor in which they are installed.
- H. Furnish electrical outlets with duplex receptacles per specification Section 26 2726 – Wiring Devices.
- I. Manufacturers: Subject to compliance with requirements, the following manufacturers are acceptable:
 1. Wiremold/Legrand/Chief
 2. FSR Inc.
 3. Hubbell
 4. Steel City

2.5 PULL BOXES, AND JUNCTION BOXES

- A. Construction, sizes and installation of pull boxes and junction boxes shall comply with NEC, Article 314.
- B. Pull and junction boxes not specifically described in NEC, Article 314, shall be fabricated of heavy gauge galvanized steel with screw or hinged covers, and equipped with corrosion resistant screws and hardware.

- C. Pull and junction boxes for installation in poured concrete floors shall be flush type, cast iron, with watertight gasketed covers. Boxes for installation in floors with tile or carpet floor covering shall have recessed covers to accommodate the floor covering.
- D. Pull boxes and junction boxes for outdoor installation shall be raintight.
- E. Pull boxes, and junction boxes designated '4X' shall be NEMA 4X watertight and corrosion resistant.

2.6 METAL WIREWAYS

- A. Construction, sizes, and installation of metal wireways shall comply with NEC, Article 376.
- B. General: Provide electrical raceways of types, grades, sizes and weights (wall thicknesses), number of channels, for each type of gutter indicated. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other components and accessories as needed for the complete system. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and comply with applicable provisions of NEC for electrical raceways.
- C. Wireways shall be constructed as a complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other components and accessories as needed for complete system. Gutters shall have hinged covers. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements.
- D. Wireways shall have hinged covers unless noted otherwise.
- E. Wireways for outdoor installation shall be raintight.
- F. Wireways designated '4X' shall be NEMA 4X watertight and corrosion resistant.

2.7 IN-GROUND HANDHOLES

- A. UL or ETL Listed, polymer concrete construction, open bottom stackable. Quazite PG style or equal.
 - 1. Manufacturer: Subject to compliance with requirements, the following manufacturers are acceptable:
 - a. Quazite
 - b. HiLine
 - c. Armorcast
 - d. New Basis
- B. All stainless steel hardware with minimum two fasteners per lid.
- C. Provide with label on cover as noted on schedule.

- D. Extra heavy duty covers with non-skid surface, tier 22, 22,500 lb. vertical and 800 lbs/sq. ft. lateral design loads, unless noted otherwise.
- E. Minimum size to be 11"x18", unless noted otherwise. Larger handholes may be required at select locations.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Raceway uses permitted and not permitted per NFPA 70 requirements and as described below.
- B. Galvanized Rigid Steel Conduit (GRS)
 - 1. Installations below grade and under concrete slabs.
 - 2. Hazardous locations except corrosive atmospheres.
 - 3. Locations subject to severe physical damage including loading docks below 8' AFF.
 - 4. Utility tunnels.
 - 5. Exposed exterior locations including roof penetrations.
 - 6. Within 1 1/2" of roof decking.
 - 7. Raceway for systems over 1000V.
 - 8. Power feeders over 2" in size.
 - 9. All locations noted for EMT conduit.
 - 10. Stub up through slab.
- C. Intermediate Metal Conduit (IMC)
 - 1. May be used as approved by code where rigid galvanized steel conduit is specified, except shall not be used for conduit buried in earth fill.
- D. Electrical Metal Conduit (EMT)
 - 1. Concealed in interior partitions
 - 2. Above suspended ceilings
 - 3. Exposed in mechanical rooms, electrical rooms, custodial closets and similar unfinished utility spaces where not subject to severe physical damage.
 - 4. Exposed, exterior locations not subject to physical damage.
- E. Flexible Metal Conduit (FMC)
 - 1. Final connections to vibrating equipment including transformers, and motor driven equipment in dry locations except pumps.
 - 2. Final connections from junction box to recessed luminaires. Lengths not to exceed 6'. Not to be used from light fixture to light fixture.
 - 3. Within door frames and casework.

F. Liquidtight Flexible Metal Conduit (LFMC)

1. Final connections to vibrating equipment including transformers, light fixtures, and motor driven equipment in wet locations including all exterior locations. To be used for all pumps.
2. Final connections to vibrating equipment including transformers, and motor driven equipment in mechanical and electrical rooms.

G. Rigid Polyvinyl Chloride (PVC) Conduit

1. Installations below grade and under concrete slabs, Schedule 40.
 - a. Where polyvinyl conduit (PVC) is provided, transition to galvanized rigid steel (GRS) conduit, or Intermediate metal conduit (IMC) where emerging from underground.

H. Type MC Cable

1. Only allowed for light fixture connections to junction box. Length limited to 6'.

I. Surface Metal Raceway

1. Use in finished spaces on existing precast, masonry, and concrete walls.

3.2 INSTALLATION OF RACEWAY

- A. In general, all horizontal runs of branch circuit conduit shall be installed in ceiling plenum. Raceway for convenience outlets, wall mounted fixtures and other wall outlets shall be routed overhead and dropped through wall to the outlet.
- B. Branch circuit raceway shall not be installed in or below concrete floor slabs except where conditions will not permit the raceway to be installed overhead.
- C. Feeder conduits to panelboards, motor control centers and other major loads may be installed in fill below concrete slabs on grade.
- D. Conduits that are run in fill below concrete slabs on grade shall be installed so as not to interfere with welded wire mesh, vapor barrier, or concrete placement.
- E. Generally, all conduit shall be concealed, except in crawl spaces, tunnels, shafts, mechanical equipment rooms, and at connection to surface panels and free standing equipment, and as otherwise noted.
- F. Exposed conduit and conduit concealed in ceiling space shall be routed in lines parallel to building construction.
- G. Do not install more than three 90 degree bends between panelboards, enclosures, junction boxes, or pull boxes
- H. All conduit runs above suspended acoustic ceilings shall be routed so as not to interfere with tile panel removals with 4'0" to 6'0" flexible conduit drops from an independent junction box, accessible from below the ceiling, to ceiling mounted equipment.

- I. Certain conduits are permitted to be embedded in structural concrete work, when permitted and coordinated with the Structural Engineer. Contractor shall cooperate with other contractors of their respective trades to affect the following:
 - 1. All reinforcing steel shall be securely anchored in place before installing conduit.
 - 2. No steel reinforcing shall be displaced from plan dimensions without approval of the Design Professional.
 - 3. Conduit and fittings shall not displace concrete in columns in excess of 4% of total cross section area of column without approval of Design Professional.
 - 4. Conduit shall not be placed closer than three (3) diameters on center.
 - 5. Maximum size of embedded conduit or pipe shall not exceed 1/3 thickness of structural slab, 2/3 thickness of topping slab.
- J. Minimum raceway size:
 - 1. Minimum size conduit shall be 1/2" trade size except all home runs to panels shall be minimum 3/4". Minimum size surface raceway shall be V500. Where specified size is not called for on drawings or in the specifications, conduit shall be sized per NEC.
 - 2. Minimum size conduit shall be 3/4" trade size. Minimum size surface raceway shall be V700. Where specified size is not called for on drawings or in the specifications, conduit shall be sized per NEC.
 - 3. FMC connections from junction box to light fixture may be 1/2" trade size.
- K. PVC coated galvanized rigid steel conduit: Install using special tools and methods approved by the manufacturer.
 - 1. Any damage to the PVC coating shall be repaired with a manufacturer approved material and method.
 - 2. All threads shall be coated with the manufacturer's approved urethane coating.
 - 3. When a PVC-coated conduit terminates into an enclosure, a PVC-coated hub is required for exit out of the enclosure with the PVC sleeve covering all exposed threads
 - 4. Where PVC coated conduit is installed, all support including support strut shall be stainless steel or a product specifically approved by the raceway manufacturer.
- L. Use approved thread lubricant for rigid steel and aluminum conduits to ensure equipment grounding paths.
- M. Use approved thread sealant for all underground and wet locations threaded conduit joints.
- N. Install the conduit system mechanically and electrically continuous from outlet to outlet and to all cabinets, junction or pull boxes. Conduit shall enter and be secured to all cabinets and boxes in such a manner that all parts of the system will have electrical continuity.
- O. All conduit penetrations to the exterior of the building including the service entrance, Communications, site feeds, grounding electrode and spare conduits shall be sealed at one or both ends against the intrusion of water and gasses. The seal shall be identified for use with the cable insulation installed. All seals shall be removable.

- P. Installation of PVC conduit shall comply with the NEC with regard to grounding and expansion fittings.
- Q. PVC conduit shall not be installed above grade unless noted otherwise.
- R. Support conduit raceway systems in accordance with requirements as set forth in the National Electric Code.
- S. Where grounding bushing are installed, provide bare bonding conductor interconnecting all bushings and connected to the equipment ground bar or solidly connected to a grounding lug at pull boxes. Conductor to be sized to match the largest equipment ground conductor.
- T. All connections to NEMA 3R enclosures shall maintain the enclosure listing regardless of the equipment location.
- U. For any location where a temperature differential exists (i.e. conditioned spaces to non-conditioned spaces), interiors of conduits shall be sealed with duct seal. Seal material shall be removeable.
- V. All penetrations of the foundation wall below grade shall be watertight. Refer to 26 0010.
- W. Underground Installation:
 - 1. Minimum cover, unless otherwise indicated or required:
 - a. Underground, exterior: 24 inches.
 - b. Under slab on grade: 6" to bottom of slab.
 - 2. Provide tracer wire in all underground raceways.
- X. Provide liquidtight flexible metal conduit for the last 3' of feeder/circuit for all vibration type equipment (i.e. motors, transformers, etc.).

3.3 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

3.4 OUTLET BOX INSTALLATION

- A. Outlet boxes shall be installed for all fixtures, switches, receptacles and other devices.
- B. Approximate locations of outlets are shown on the plans, but each outlet location as shown shall be checked by Contractor before installing the outlet box.

- C. Wall boxes installed flush in common wall shall not be back-to-back or through wall type. Boxes located on opposite sides of a common wall that are closely connected by conduit shall have the conduit openings plugged with duct seal.
- D. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.
- E. Outlet boxes shall be installed plumb and square with wall face and with front of box or cover located within 1/8" of face of finish wall. Boxes in masonry shall be set with bottom or top of the box tight to the masonry unit.
- F. Contractor shall verify recessed box mud ring extension depth with architectural wall construction and finishes.
- G. Outlet box installation shall maintain the fire rating of the wall in which they are installed. Install listed putty pads per UL requirements.

3.5 PULL BOX, JUNCTION BOX & WIREWAY INSTALLATION

- A. Install pull boxes, junction boxes and auxiliary wiring gutters where indicated on drawings and where required to facilitate installation of the wiring.
- B. For concealed conduit, install boxes flush with ceiling or wall, with covers accessible and easily removable. Where flush boxes are installed in finish ceilings or walls, provide cover which shall exceed the box face dimensions by a sufficient amount to allow no gap between box and finished material.
- C. Boxes shall not be located in finished, occupied rooms, without prior approval of Design Professional.
- D. Wall and floor duct installation
 - 1. Install in accordance with the manufacturer's instructions.
 - 2. Provide openings and grommets as required. All duct edges shall be filed and deburred to prevent damage to cables.

3.6 EXPLOSIONPROOF INSTALLATIONS

- A. The electrical installation shall be in compliance NEC Article 500 for Class I, II, & III, Division 1, 2 hazardous locations as noted on the drawings. Provide seal-offs, junction boxes, and fittings, as required.
- B. Connections for vibrating or moving equipment shall use UL listed flexible couplings for used in explosionproof atmospheres. Flexible couplings shall be stainless steel where installed in corrosive atmospheres.

3.7 ACTIVATION BOX INSTALLATION

- A. Install activation boxes flush with surrounding wall or floor surface, factor in lids and covers in addition to wall/floor finishes when setting boxes.
- B. Coordinate raceway into boxes with Telecom and AV Contractors to limit the number of bends and entry into appropriate sides of boxes.
- C. Coordinate exact placement of boxes with Architectural details, do not scale drawings for locations.
- D. All floor activation boxes within the same area shall be oriented in the same direction.

3.8 IN-GROUND HANDHOLE INSTALLATION

- A. Install all handholes flush with surrounding grade. Adjust handholes as required for finished grade.
- B. Do not install handholes at low grade points. Install at locations to allow drainage away from box.
- C. Provide 1" clean compacted fill beneath handholes for drainage. Clean fill shall extend 8" beyond the sides of the handhole enclosure, and a minimum of 12" deep.

3.9 COMMUNICATIONS RACEWAY INSTALLATION

- A. The term "Communications" includes all low voltage technology systems including voice and data, access control, video surveillance, intrusion detection, audio video, induction loop, paging, intercom, nurse call, school bell and/or clock systems. The term does not include fire alarm system, which is addressed separately in the plans and specifications.
- B. See Section 270528.33 for Communication Raceway requirements.
- C. Contractor shall furnish and install Communications boxes and conduits, including wall sleeves unless otherwise noted. Provide dedicated sleeves for each of the following systems unless a consolidated pathway(s) system is provided and filled to less than 40% capacity after all cables are installed:
 - 1. Data and voice
 - 2. Access control, video surveillance, intrusion detection
 - 3. Audio Visual
 - 4. Paging, intercom, school bell, clock system
 - 5. Nurse Call
 - 6. Emergency two-way communication
 - 7. Emergency responder radio communication system, (ERRCS).
 - 8. All other life safety or security systems that are not fire alarm or not already listed.

- D. Below-grade building entrance conduits within the building footprint shall be Schedule 40 PVC unless otherwise noted. Long sweep ninety-degree elbows for conduits under the building footprint shall be fiberglass sweeps with Schedule 40 PVC conduit connectors built into the ends of the sweeps. Sweeps with a 4" diameter shall have a minimum radius of 36".
1. Underground conduits outside the building footprint shall be continuous orange HDPE (high density polyethylene) with 1250 pound braided mule tape used as pull string unless otherwise noted. Round pull string or other rope is not acceptable for pulling due to risk of raceway damage. HDPE manufacturer approved water proof couplers shall be used for conduit type transition. HDPE to HDPE connection shall be hot fusion splice.
 2. HDPE shall be minimum SDR 17 wall thickness for 2" diameter and smaller. The wall thickness shall be minimum SDR 11 for sizes larger than 2" diameter.
 3. All below grade conduits shall be plugged at each end during construction to keep water, mud, rodents, etc., out.
 4. All below grade entrance conduits shall be plugged on each end with removable mechanical plugs to keep water from entering the building for the life of the building. These plugs shall be installed inside the building above slab, and also at the first hand-hole outside the building (or where the conduits terminate underground). These plugs shall also seal around the utility entrance cables, including in and around all sub-ducts for a complete watertight seal. These mechanical plugs shall be as found on www.innerduct.com or engineer approved equivalent. Coordinate with the utility to determine size of cables for the plug inserts required. This work shall be completed before the Owner occupies the building.
 5. All below grade exterior conduits shall have a tracer wire with adequate slack loop at each end for owner to conveniently connect and trace. All tracer wires shall protrude from closed hand holes so tracing may be accomplished without lifting the hand hole lid.
 6. Contractor shall provide and install hand holes for cable pulling in buried raceway at a maximum interval of 500'.
- E. Interior Installations:
1. Interior building, above grade conduits and sleeves shall be EMT unless otherwise noted. PVC is never acceptable above grade.
 2. All interior conduits shall have bushings installed during conduit installation.
 3. All conduit sleeves shall have bushings installed at both ends during sleeve installation.
 4. All interior conduits shall have pull strings, except sleeves which are less than 4' long. EMT conduits shall receive standard round cable pull string (multi-strand plastic twine type).
 5. Minimum interior conduit size for all information jacks (voice data cabling) shall be 1" unless otherwise noted.
 6. Minimum interior conduit size for audiovisual systems shall be 1" unless otherwise noted.
 7. Minimum interior conduit size for video surveillance, intrusion detection, paging, intercom, school bells and/or clock systems shall be 1" unless otherwise noted.
 8. Nurse call system conduit sizes shall be per the nurse call rough-in schedule found on drawings.

9. Access control system conduit sizes at the door location shall be per the access control detail found on the drawings. The conduit from the door location to the access control head end shall be minimum 3/4".
10. Boxes for all low voltage systems in stud walls shall be metallic 5"x5"x2.875" with single gang mud ring unless otherwise noted.
11. Boxes in masonry walls shall be minimum 3.5" deep. single gang, unless otherwise noted.
12. Wiremold surface raceway for all low voltage systems shall be minimum V2400 unless noted otherwise.
13. Wiremold surface boxes for all low voltage shall be minimum 2.5" deep single gang, unless otherwise noted.
14. Conduits inside walls which feed the low voltage side of dual compartment Wiremold shall be minimum 1.25" unless otherwise noted.
15. Install conduit pathways per ANSI TIA-569 for all technology systems.
 - a. No section of conduit shall contain more than two (2) 90 degree bends, or equivalent, between pull points. e.g., outlet boxes, pull boxes, distribution rooms.
 - b. A pull box shall be placed in a conduit run where:
 - 1) The length is over 100 ft.
 - 2) There are more than two 90 degree bends or equivalent.
 - 3) There is a reverse U-shaped bend in the conduit run.
16. Pull boxes shall be placed in a straight section of conduit.
17. Pull boxes shall not be used in place of a bend. The corresponding conduit ends should be aligned with each other.
18. A pull box shall be accessible.
19. A pull box shall not be placed in an inaccessible ceiling space unless immediately above a suitable marked access panel.
20. Conduit body fittings e.g., LB or LC fittings are not considered pull boxes and shall not be used where a pull box is required per ANSI or unless noted otherwise.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall provide identification for wiring systems and equipment as called for in this section.
- B. Types of electrical identification specified in this section include the following:
 - 1. Conduit color banding.
 - 2. Buried cable warnings.
 - 3. Cable conductor identification.
 - 4. Operational instructions and warnings.
 - 5. Danger signs.
 - 6. Equipment/system identification signs.

1.3 QUALITY ASSURANCE

- A. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Color Coded Conduit System

1. General: Provide manufacturer's standard colored conduit for EMT installations as noted below. For rigid aluminum, rigid steel, and IMC conduit, use colored electrical tape to band conduits within 6" of termination at each switchboard, panelboard, distribution board, pull box and junction box. Where conduit is exposed and painted to match adjacent surfaces, band with colored electrical tape.
2. Colors:
 - a. Normal Power: gray/silver (uncolored)
 - b. Emergency (EPSS): yellow* (match building standard)
 - c. Optional Standby: white* (match building standard)
 - d. Fire alarm: red*
 - e. Division 27 systems: blue**
 - f. Division 28 systems excluding fire alarm: purple**

* Factory colored conduit required for EMT conduit
** Field applied electrical tape banding at conduit terminations required.
Factory colored conduit optional for EMT conduit.
3. For exposed conduits in finished spaces, refer to architectural for paint to match room finish.

C. Cable/Conductor Identification Bands

1. General: Provide manufacturer's standard vinyl cloth self-adhesive cable/conductor markers of wrap around type; either pre numbered plastic-coated type or write on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

D. Self-Adhesive Tape for Receptacle Circuit Identification

1. General: Provide clear self-adhesive or pressure sensitive, preprinted, flexible vinyl tape for panel name and circuit number.

E. Engraved Plastic Laminate Signs

1. General: Provide engraving stock melamine plastic laminate, in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - a. Thickness: 1/16", for units up to 20 sq. in. or 8" lengths; 1/8" for larger units.
 - b. Fasteners: Self tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements

1. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

B. Conduit Identification

1. Conduit above accessible ceiling spaces shall be identified per 2.01 B.
2. Pre-printed, flexible, self-adhesive vinyl labels with legend at 20-foot intervals to identify all conduits run exposed or located above accessible ceilings.
3. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color coded method, apply color coded identification on electrical conduit in a manner similar to piping identification.
4. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3-feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors.
5. Labels for multiple conduits shall be aligned.
6. Identify junction and pullboxes of systems with stencil lettering for panel and circuit numbers or system type.

C. Box Identification

1. For branch circuits, mark panel name, circuit numbers, and voltage on all junction/pull boxes.
 - a. Exposed boxes in finished areas shall be labeled on inside of cover.
 - b. Exposed boxes in unfinished areas shall be labeled on outside of cover.
 - c. Concealed boxes above accessible ceilings shall be labeled on outside of cover. J-box covers should be painted to match conduit color.

D. Underground Cable/Conduit Identification

1. General: During back filling/top/soiling of each exterior underground electrical, signal or communication cable or conduit, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16, install a single line marker.

E. Cable/Conductor Identification

1. General: Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents and similar previously established identification for project electrical work.

F. Operational Identification and Warnings

1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

G. Equipment/System Identification

1. General: Install engraved plastic laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1 1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work.
 - a. Panelboards, electrical cabinets and enclosures.
 - b. Access panel/doors to electrical facilities.
 - c. Major electrical switchgear.
 - d. Motor control centers, disconnects & starters.
 - e. Power transfer equipment.
 - f. Transformers.
 - g. Inverters.
 - h. Generators.
 - i. Pushbuttons
 - j. Pilot lights
 - k. Alarm/signal components
2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.
3. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation.
4. Provide labeling of Enclosed Circuit Breakers, Switchboards, Panelboards and Disconnects per NEC Articles 110, 700 and 702 for multiple services and essential electrical system.
5. All receptacles and light fixtures shall be labeled with panel and circuit number. Final location of label shall be field coordinated. If labeling is to be on outside of cover, Contractor shall use clear dyno-tape with black lettering that matches other tags.
6. All panelboards shall be labeled with panel ID, conduit size, feeder wire size, origin and size of overcurrent protection device serving panelboard and phase schedule. Format shall be as follows:

"Panel XX, 1.25"C, 4#3, 1#8, Fed from Dist. Bd. XX by 100A/3P
Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White"

7. All new switchboards and panelboards shall be labeled (5/32" or larger) with the following:
"Caution – This equipment has a minimum short circuit design requirement of ____KA. All devices installed must have a rating equal or higher than the design requirement."
8. All safety switches shall have a permanent label attached to inside of cover describing the fuse size, type, current limiting ability and devices controlled.

END OF SECTION 260553

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SECTION 260923 - LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. The facility has existing partial Lutron stand-alone wireless controls using PowPacs , wireless sensor and Pico Switches. All ceiling sensors are to be removed to accommodate new ceiling. Manual stations (all on/off) may be re-used or replaced to accommodate dimming sequence of operator as noted. Where dimming controls are noted, power packs will need to be replaced. All controls will be required to be re-commissioned.
- B. Provide materials, equipment, labor and supervision necessary for a complete operational lighting control system as required by the drawings and this section.
- C. This section applies to all work under this division. This shall include, but not necessarily be limited to, the following:
 - 1. Furnish, install, and terminate all system equipment and cabling as applicable and per drawings for a wired control system. No wireless control components.
 - 2. Furnish and install any cabinets, racks and cable management as required and as indicated.
 - 3. Furnish any other material required to form a complete and operational system.
 - 4. Provide As-Built drawings per Division 0 and/or Division 1 specification.
 - 5. Provide Owner training and testing documentation.
 - 6. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft.
 - 7. All work shall be performed in a neat, workmanlike manner in keeping with the highest standards of the craft.

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring devices.
- B. UL Compliance and Labeling: Provide electrical wiring devices which have been UL listed and labeled.
- C. NEMA Compliance: Comply with NEMA standards for general and specific purpose wiring devices.

- D. ASHRAE Compliance: Comply with ASHRAE 90.1-2010 section 9.
- E. All Contractors shall familiarize themselves with all codes and standards applicable to their work. No extra compensation will be allowed for corrections or changes in the work required due to failure to comply with the applicable codes and standards. Where two or more codes or standards are in conflict, that requiring the highest order of workmanship shall take precedence, but such questions shall be referred to Design Professional for final decision.

1.4 SUBMITTALS

- A. Submit manufacturer's product data literature for each lighting control component required. For occupancy sensors and related components, submit Manufacturer's device layout indicating recommended device placement, product data and project specific wiring diagrams. Submittals shall include the Sequence of Operation for each area of lighting control.

1.5 WARRANTY

- A. The control system designated on the drawings and plans and herein specified shall be guaranteed to be free from original defects in both material and workmanship for a period of five (5) years. This warranty shall become effective starting the date of project substantial completion.

1.6 SYSTEM DESCRIPTION

- A. System Architecture:
 - 1. The lighting control system shall be a non-networked, distributed lighting control system. The system shall have no central monitoring, control or time functions. Each individual room or area shall have a standalone control system that is not dependent on a network for any reason including programming.
 - 2. All system adjustments for time delays, high-level trim, low-level trim, fade times, blink warnings, photo sensor sensitivity, daylight setpoints, receptacle control time delays, vacancy mode, occupancy mode, etc. shall be programmable and adjustable without the use of a ladder.
- B. Lighting control system for manual and automatic control of interior lighting systems.
 - 1. Space Control – Provide occupancy/vacancy control with manual occupant input as noted on the lighting control sequence schedule.
 - 2. Daylit Areas – All luminaires in the daylit zone shall be controlled separately from luminaires outside of daylit zones. Luminaires in the primary daylit zones shall be controlled separately from luminaires in secondary daylit zones.
 - 3. Daytime setpoints for total ambient illumination (combined daylight and electric light) level that initiate dimming shall be programmed to be not less than 125% of the nighttime maintained designed illumination levels.

4. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system will be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn fixtures back on at dimmed level, rather than turning full-on prior to dimming.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide lighting control systems of one of the following:
 1. Lutron Vive
- B. Device Color: Wall mounted devices and coverplates shall match colors identified in section 262726 – Wiring Devices.

2.2 LINE VOLTAGE SINGLE / DUAL RELAY WALL SWITCH OCCUPANCY SENSORS (STAND-ALONE)

- A. Dual Technology: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor. 0-10V dimmable where noted. Two zone where noted. Furnish the model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled. 120/277VAC rated.

2.3 WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Description: Wall or ceiling mounted passive infrared (PIR), ultrasonic/microphonic, or dual technology occupancy sensor. Wireless PIR sensors are acceptable. Furnish the system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, occupancy sensors and accessories which suit the lighting and electrical system parameters.
- B. Specific sensors shall be selected based on the mounting height and device placement indicated as well as the performance characteristics of the manufacturer's proposed sensor. Where the manufacturer determines the controlled space exceeds the sensing range of the available sensors, additional sensors shall be included.
- C. Sensor shall be compatible with the environment installed.
 1. Indoor sensors in controlled environments shall be rated for use from 0 degrees C to 40 degrees C.
 2. Outdoor sensors shall be NEMA 3R or 4X, rated for use from -40 degrees C to 65 degrees C.
 3. Sensors in specialty areas (freezers, hose-down areas, etc.) shall be selected for the specific application.

2.4 LIGHTING CONTROL STATION

- A. Description: Low voltage or wireless control station in multi-button configuration compatible with wall plates with decorator opening. Control stations shall include the following features:
 - 1. Engraving where indicated on the drawings.
 - 2. LED Pilot Lights: Required where indicated on Drawings.
- B. Control stations shall be able to function as noted below:
 - 1. Load and Scene button function may be reconfigured for individual buttons.
 - 2. Individual button function may be configured to Toggle, On only, Off only, Raise or Lower.
 - 3. Individual scenes may be locked to prevent unauthorized change.

2.5 ROOM CONTROLLERS

- A. Room Controllers shall be provided to match the room lighting load and control requirements. The control units will include the following features:
 - 1. Dual voltage (120/277 VAC, 60 Hz)
- B. On/Off Room Controllers shall include:
 - 1. One or more relay configuration
 - 2. Relay controller listed for connection to receptacles, for occupancy-based control of plug loads within the space.
 - a. One relay configuration only, rated at 20A, 120VAC.
 - b. Automatic-ON/OFF configuration
- C. On/Off/Dimming Room Controllers shall include:
 - 1. One or more relay configuration
 - 2. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
 - 3. The following dimming attributes may be changed or selected via programming:
 - a. Establish preset level for each load from 0-100%
 - b. Set high and low trim for each load

2.6 PHOTOSENSORS

- A. Photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install components as indicated on the drawings and as called for below.
- B. Low-voltage lighting control cables shall not share raceway or cable tray with telecommunications wiring. All cable shall be neatly routed and tie-wrapped to structural components. Excess wire shall be neatly coiled and secured to structure. Under no circumstances shall cable be supported by piping, conduit, ductwork, ceiling tile, or ceiling support wires. Cable shall be neatly routed in line with building lines.
- C. Provide a 8' coil of cable at each ceiling mounted device for ease of relocation if conflicts arise.
- D. Where concealed in walls or ceilings, lighting control cable shall be installed in conduit. Refer to 26 05 22 - Raceways and Boxes for Electrical Systems.
- E. All low-voltage lighting control cables shall be plenum rated.
- F. Where devices are installed in finished locations without ceilings, lighting control cables shall be installed in conduit.
- G. Where installed above accessible ceiling, all components shall be located in easily accessible areas. Any controller located in an area above a non-removable ceiling tile or where obstructed by piping or duct work shall be relocated. All locations shall be recorded on as-built drawings.
- H. Low voltage lighting control cable shall not use the same conduit sleeves as fire alarm or telecommunications cable. Provide dedicated sleeves. Where installed within non-accessible permanent construction or in exposed areas, provide continuous raceway to accessible location.
- I. It is the Contractor's responsibility to determine the ceiling type for each space and provide accessories as required for installation of devices in ceiling.
- J. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
- K. It is the Contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative at the Owner's facility to verify placement of sensors and installation criteria.
- L. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- M. Occupancy Sensors shall be installed in accordance with manufacturer's instructions.
 - 1. Where devices are directional, devices shall be placed to sense occupancy of the area controlled by the device.

- N. Photosensors shall be installed in accordance with the manufacturer's requirements.
 - 1. Open loop sensors shall be placed to sense only the natural light entering the space with no artificial light component.
 - 2. Closed loop sensors shall be placed within the zone of controlled light. Closed loop sensors shall be placed and oriented to sense the light level on the work plane. Do not locate where the sensor is blocked or illuminated by suspended light fixtures or other objects within the space.
- O. Calibrate all sensor time delays and sensitivity to provide proper detection of occupants and energy savings.
 - 1. Adjust time delay so that controlled area remains lighted for 15 minutes after occupant leaves area or as indicated in the Sequence of Operations.
 - 2. Adjust lighting system to provide maximum lighting levels as indicated on the drawings.
- P. Provide 120V or 277V circuits as required for lighting control components.
- Q. Provide network information jacks as required for lighting control system.
- R. Install emergency lighting control units (ELCU) in accordance with manufacturer's requirements.
 - 1. ELCU shall be located in an accessible location to allow access to the test button. Where ELCU is not accessible from an 8' step ladder, install remote test button.

3.2 FACTORY COMMISSIONING

- A. Upon completion of the lighting control(s) installation, the lighting control system (all sensors and control equipment) shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. The electrical contractor shall modify sensor locations and wiring as directed by the factory technician as required to achieve required functionality.
- B. Upon completion of the lighting control system fine tuning the factory authorized technician shall provide the proper training to the Owner's personnel in the adjustment and maintenance of the sensors.
- C. Re-commissioning. After 90 days from Owner occupancy, review system performance with the Owner and recalibrate all sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report of re-commissioning activity.
- D. Provide written or computer-generated documentation on the commissioning of the system including room by room description. Report to include:
 - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3. Load Parameters (e.g. blink warning, etc.)

3.3 TRAINING

- A. Provide three (3) two-hour training sessions for the Owner. The first training session is to be at the time of initial system startup. The second session is to be post-occupancy. The third session is to be used at Owner's discretion. The training is to include, but not limited to the following:
1. Detailed review of the system architecture, individual components, and wiring requirements.
 2. System programming method included examples and demonstrations. These are to include adjustments for time delays, high-level trim, low-level trim, fade times, blink warnings, receptacle control time delays, vacancy mode, occupancy mode, etc.
 3. Occupancy sensitivity adjustments for both PIR and ultrasonic setting, adjustments for an automatic learning mode and the ability to disconnect, and selection between PIR and Ultrasonic modes for dual technology devices.
 4. System troubleshooting including types of component failures, associated system failure and repair/replacement and reprogramming procedures.

3.4 SPARE PARTS

- A. Spare Parts: Provide the following list of spare equipment (for each type used) to Owner to match equipment used in project.
1. Occupancy Sensor– quantity: 2 of each type installed
 2. Room Controller-dimming, one zone – quantity: 2
 3. Control Station, - Quantity: 2 of each type installed
 4. Any specialty tool required for programming - Quantity: 1

END OF SECTION 260923

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SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to install transformers as specified in this section and as called for on the drawings.

- 1. Dry-type Transformers.

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.
- B. NEMA Compliance: Comply with applicable portions of NEMA Std Pub Nos. TR 1 and TR 27 pertaining to power/distribution transformers.
- C. ANSI/IEEE Compliance: Comply with applicable ANSI/IEEE standards pertaining to power/distribution transformers.
- D. ANSI/NEMA Compliance: Comply with NEMA Std ST 20; "Dry Type Transformers for General Applications".
- E. UL Labels: Provide distribution transformers which have been UL listed and labeled.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's technical product data including rated KVA, frequency, primary and secondary voltages, percent taps, polarity, impedance and certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no load and full load losses in watts, % impedance, hot spot and average temperature rise above 40 deg. C. ambient, sound level in decibels, and standard published data.
 - 2. Drawings: Submit manufacturer's drawings indicating dimensions, and weight loadings for transformer installation.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):
 - 1. Schneider Electric/Square D (match building standard)

2.2 POWER/DISTRIBUTION TRANSFORMERS

- A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
- B. Dry Type Distribution Transformers: Provide factory assembled, general purpose, air cooled, dry type distribution transformers where shown; of sizes, characteristics, and rate capacities indicated. Provide primary windings with 6 taps; 2, 2 1/2% increments above full rated voltage and 4, 2 1/2% increments below full rated voltage for de energized tap changing operation. Limit transformer surface temperature rise to maximum of 65 deg.C. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections. Insulation class of 220 deg. C, UL Component recognized insulation system. Limit terminal compartment temperature to 75 deg.C when transformer is operating continuously at rated load with ambient temperature of 40 deg.C. Cushion mount transformers with external vibration isolation supports; sound level ratings as determined in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall mounting.
 - 1. Isolation Transformers
 - a. Provide transformers with electrostatic shielding where indicated on drawings.
 - b. Provide independent copper electrostatic shield for each winding to minimize capacitance between windings.
 - c. Provide separate grounding terminals for the shield on each winding.

- d. Shielding shall
 - 1) Limit capacitance between primary and secondary windings.
 - 2) Attenuate common-mode noise.
 - 3) Attenuate normal-mode noise.

PART 3 - EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

- A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- C. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.
- D. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.
- E. Install units on vibration mounts; comply with manufacturer's indicated installation method if any.
- F. Grounding: Provide equipment grounding connections, sufficiently tight to assure permanent and effective ground, for transformers as indicated.
- G. Transformers shall be connected to the raceway system with flexible conduit.
- H. Testing: Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 262200

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to install lighting panelboards and distribution panelboards as specified in this section and as called for on the drawings.
- B. Types of panelboards and enclosures in this section include the following:
 - 1. Lighting and appliance panelboards.
 - 2. Power distribution panelboards.

1.3 QUALITY ASSURANCE

- A. Compliance: Comply with applicable UL safety standards pertaining to panelboards and accessories, and enclosures; provide units which have been UL listed and labeled.
- B. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets and cutout boxes.
- C. NEMA Compliance: Comply with NEMA Stds. Pub. No. 250, "Enclosures for Electrical Equipment (1000 volt maximum)", Pub. No. 1, "Panelboards", and installation portion of Pub. No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's data including specifications, installation instructions and general recommendations, for each type of panelboard required. Include data substantiating that units comply with requirements.
 - 2. Drawings: Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground fault circuit interrupters and accessories.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings
 - b. Include manufacturer's maintenance information.
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Schneider Electric/Square D (match building standard)

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information; equip with number of unit panelboard devices as required for complete installation.
 - 1. All Multi-Section Panels: Same dimensions.
 - 2. Provide two keys for each panel.
 - 3. Provide copper ground bar.
 - 4. All panels shall have a designed short circuit rating label.
- B. Lighting and Appliance Panelboards:
 - 1. Panelboard bus structure and main lugs or main breakers shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bussing shall be distributed phase sequence type.
 - 2. The bus assembly shall be enclosed in a steel cabinet. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The rigidity and gauge of steel to comply with UL Standard 50 cabinets. Provisions for additional circuit breakers shall be such that field addition to connectors or mounting hardware will not be required to add circuit breakers to the panelboards.
 - 3. If ground fault interrupting breakers (GFI), switched neutral or other special types of breakers require additional pole spaces, size of panel shall be increased accordingly to give the scheduled numbers of poles for spare breakers and blank spaces.

4. Fronts shall include doors and have flush, stainless steel, cylinder tumbler type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim ring clamps which shall be completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuitry directory frame and card with a clear plastic covering shall be provided on the inside of the door.
5. Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for conductor specified.
6. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule. Series connected interrupting ratings are not acceptable. This short circuit current rating shall be established by testing with the overcurrent devices mounted on the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of applying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
7. Bus Bar: Aluminum or Copper.
8. Panelboards shall have door-in-door covers.

C. Power Distribution Panelboards; Circuit Breaker Type:

1. Panelboards to be used for main circuit distribution and power circuit distribution shall be similar to lighting panelboards with the following additions:
 - a. Cabinet doors over 48" long shall be equipped with three point latch and vault lock. End walls shall be removable.
 - b. Main lugs or main breakers shall be barriered on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall be barriered.
 - c. When required, panelboards shall be suitable for use as service equipment.
 - d. Bus Bar: Copper.

2.3 CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.

B. Circuit Breakers - Branch Circuit Panelboards:

1. Branch circuit breakers up to 150 amperes shall be Square D Type QOB or equal. Breakers shall be bolt-on type toggle action with quick-make, quick-break mechanism. Trip indication shall be clearly shown by the breaker handle taking a position between on and off when the breaker is tripped. All multi-pole breakers shall be single-operated handle, internal common trip. Breakers having handle ties but not factory labeled "common trip" will be rejected. UL Class A ground fault circuit protection and arc fault protection shall be provided on 120V AC branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V AC and carry the SWD marking. Tandem or "piggyback" breakers providing two circuits from one pole space are prohibited.

C. Circuit Breakers - Distribution Panelboards:

1. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
2. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with fully connected rating to meet available fault currents. No series rated devices.
 - a. Breakers 20A to 125A:
 - 1) Thermal magnetic trip.
 - b. Breakers 150A-225A: Electronic trip with true RMS sensing
 - 1) Adjustable long-time pick-up setting
 - 2) Adjustable long-time delay.
 - 3) Adjustable instantaneous trip settings.
 - 4) Adjustable short time pick-up settings with I²t delay.
 - 5) Ground fault pick-up & delay where ground fault protection is indicated.
 - 6) Local status indicator showing breaker status and trip log for last (5) trip events.
 - 7) Trip unit shall include real time metering for voltage, current, power and frequency.
 - c. Breakers 250A-700A: Electronic trip with true RMS sensing
 - 1) Adjustable long-time pick-up setting
 - 2) Adjustable long-time delay.
 - 3) Adjustable instantaneous trip settings.
 - 4) Adjustable short time pick-up settings with I²t delay.
 - 5) Ground fault pick-up & delay where ground fault protection is indicated.
 - 6) Local status indicator showing breaker status and trip log for last (5) trip events.
 - d. Trip unit shall include real time metering for voltage, current, power and frequency. Breakers 800A and larger: Electronic trip with true RMS sensing
 - 1) Adjustable long-time pick-up setting
 - 2) Adjustable long-time delay.
 - 3) Adjustable instantaneous trip settings.
 - 4) Adjustable short time pick-up settings with I²t delay.

- 5) Ground fault pick-up & delay where ground fault protection is indicated.
 - 6) Local status indicator showing breaker status and trip log for last (5) trip events.
 - 7) Breakers 1200A or larger shall be provided with an energy reduction maintenance switch.
 - 8) Trip unit shall include real time metering for voltage, current, power and frequency.
- e. Refer to the equipment schedules for special provisions for select circuit breakers including variations of the requirements noted above, ground fault trip, ground fault alarm, shunt-trip, undervoltage trip, and zone selective interlocking.

2.4 SURGE PROTECTIVE DEVICE (SPD)

- A. SPD shall meet UL 1449, Type 2 requirement.
- B. SPD shall be integral to the panelboard.
- C. SPD shall have a minimum surge current capacity of 120,000A per phase, 60,000A per mode.
- D. Provide 60A circuit breaker to connect SPD to bus.
- E. Panelboard SPD per section 26 4313 – Surge Protective Devices.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS

- A. General: Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Securely anchor panelboards to structure and make feeder and branch circuit connections as indicated in specifications and on the drawings.
- C. Each panelboard directory shall be typewritten to identify the load fed by each circuit. Spare breakers and circuits to be left blank with circuit breaker in off position.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 - Procurement and Contracting Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide materials, equipment, labor and supervision necessary to install wiring devices as required by the drawings and this section.
- B. Types of wiring devices this section include the following:
 - 1. Straight blade receptacles
 - 2. GFI receptacles
 - 3. USB charging receptacles
 - 4. Wall switches
 - 5. Wiring device accessories

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring devices.
- B. UL Compliance and Labeling: Provide electrical wiring devices which have been UL listed and labeled.
- C. NEMA Compliance: Comply with NEMA standards for general and specific purpose wiring devices.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data: provide one submittal containing the following information:
 - 1. Manufacturer's catalog cuts showing complete descriptive data for each type of wiring device required.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.

- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data.
 - 2. Startup and test reports: Submit reports immediately upon completion of tests.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Hubbell, Inc.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Pass & Seymour / Legrand

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Device Color:
 - 1. Device color shall be selected by the architect at the time of submittal review.
 - 2. Device color may not be consistent throughout the building. Select areas may require special colors. Refer to Architectural elevations and finishes.
 - 3. Device model numbers indicated below to not include a color suffix. Model numbers listed do not indicate brown device color.
 - 4. Where a device is shown connected to an emergency circuit, it shall have a "red" body.
- B. Modular Connectors: Devices that are manufactured for use with modular plug-in connectors (snap connect, plug tail, etc.) may be substituted. Plug in connectors shall meet the following conditions:
 - 1. Connectors shall comply with UL498 and shall be made with stranded building wire.
- C. Weather Resistant:
 - 1. Devices located at exterior and wet locations shall be weather resistant. Provide weather resistant versions of the model specified.
 - 2. Refer to Part 3 - Execution section for required locations.
- D. Controlled Receptacles:
 - 1. Where receptacles that are noted to be automatically controlled through the lighting control system, they shall be permanently marked "CONTROLLED" with the controlled symbol as defined in NFPA 70.

2. For duplex receptacles, one or both outlets shall be permanently marked as noted.

E. Isolated Ground Receptacles:

1. Devices marked 'IG' shall be Isolated Ground type.
 - a. Receptacle shall be orange in color and marked with a triangle symbol on the receptacle face.

2.3 STRAIGHT BLADE RECEPTACLES

- A. Commercial Specification Grade Convenience Receptacles 125 V, 20 A, Tamper Resistant: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Hubbell HBL5361TR (simplex), BR20TR (duplex).
2. Pass & Seymour 5361TR (simplex), CRB5362TR (duplex)
3. Leviton 5361TR (simplex), BR20TR (duplex)

- B. Commercial Specification Grade Convenience Receptacles 125 V, 15 A, Tamper Resistant: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and FS W-C-596.

1. Hubbell HBL5261TR (simplex), BR15TR (duplex).
2. Pass & Seymour 5261TR (simplex), CRB5262TR (duplex)
3. Leviton 5261TR (simplex), BR15TR (duplex)

2.4 GFCI RECEPTACLES

- A. Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596. Configuration 5-20R. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection. Self-testing, 4 to 6mA trip. Hubbell is basis of design. Other manufacturers as listed above are acceptable.

1. Heavy duty tamper resistant: Hubbell GFTRST20
2. Heavy duty tamper resistant and weather resistant: Hubbell GFTWRST20
3. Heavy duty faceless. Hubbell GFBFST20

2.5 USB CHARGING RECEPTACLES

- A. USB Charging Convenience Receptacles, 125 V, 20 A, tamper resistant. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596. Compatible with USB 1.1/2.0/3.0 devices, including Apple products. Class 2 power supply. Hubbell is basis of design. Other manufacturers as listed above are acceptable..

1. 5VDC, 5A USB output. One USB Type A port and one USB Type C port. Hubbell USB20AC5

2.6 WALL SWITCHES

- A. Heavy duty industrial grade switch. Comply with NEMA WD 1, and FS W-S-896. Hubbell is basis of design. Other manufacturers as listed above are acceptable.
1. Single pole toggle light switch 20 amp, 120 277 volt, Hubbell #1221 series.
 2. Double pole toggle light switch 20 amp, 120 277 volt, Hubbell #1222 series.
 3. Three way toggle light switch 20 amp, 120 277 volt Hubbell #1223 series.
 4. Four way toggle light switch 20 amp, 120 277 volt, Hubbell #1224 series.
 5. Double pole double throw center off light switch 20 amp, 277 volt, Hubbell #1386 series.
 6. Momentary contact switch 15 amp, 120 277 volt, Hubbell #1556 series.

2.7 WIRING DEVICE ACCESSORIES

- A. Cover Plates:
1. Smooth High-Impact Thermo plastic (nylon, unbreakable), Hubbell NP Series or equal.
 2. Plates for surface outlets shall be of the raised cover type utilizing 4" square boxes.
 3. Outlets Installed Outdoors and in Wet Locations:
 - a. Weatherproof Flip Cover ("WP"): Weatherproof device covers shall consist of cast metal cover plate and cap over each opening. The cap shall be permanently attached to the cover plate by a spring hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
 - 1) Horizontally mounted devices shall have cover plate aligned for same mounting, equal to Hubbell CWP series.
 - 2) Vertically mounted devices shall have cover plate aligned for same mounting, equal to Hubbell WP series.
 - b. Weatherproof Cord and Plug Cover ("WPD"): Extra duty, while-in-use, NEMA 3R cover. Heavy-duty die cast metal construction, UL 514D. Hubbell WP26 series or equal.
 - c. Weatherproof Cord and Plug Cover ("WPD"): Extra duty, while-in-use, NEMA 3R cover. High-impact UV stabilized clear polycarbonate construction, UL 514D. Hubbell extra duty RW58 series or equal.
 - d. Weatherproof Cord and Plug Cover ("WPD"): Extra duty, while-in-use, NEMA 3R cover. Non-metallic UV stabilized polycarbonate and synthetic neoprene rubber construction expandable from 1 to 3 inches, UL 514D. Hubbel/Taymac ML500 series or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated on the drawings and as called for below.

- B. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
- C. In masonry walls, switches and receptacle heights shall be adjusted as required so outlets are at nearest mortar joint to specified height.
- D. Where light switches are located adjacent to doors, they shall be installed on "knob" side of door, unless indicated otherwise.
- E. Switched duplex receptacles shall be wired so that only the top receptacle is switched; the remaining receptacle shall be unswitched.
- F. All GFI type receptacles shall be installed where GFI notation is shown on plans. No downstream protection of receptacles will be allowed from load side of other GFI type receptacles unless specifically noted on drawings.
- G. All GFI receptacles shall be accessible for testing. Where a GFI receptacle is located behind equipment, a faceless GFCI device shall be provided in an adjacent accessible location.
- H. All receptacles within 6' of the edge of a sink shall be GFI type, Contractor shall notify Engineer prior to installation if the drawings do not indicate these as GFI.
- I. Prior to roughing in outlet boxes, Contractor shall verify from general construction drawings, door swings, type of wall finishes and locations for counters and work benches.
- J. Receptacles shall be installed with ground terminal up. Horizontal receptacles shall be installed with the grounded (neutral) terminal up.
- K. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
- L. The grounding terminal of isolated ground receptacles shall be connected to an insulated equipment grounding conductor (green with yellow stripe) dedicated to that branch circuit. The receptacle box and device strap shall be connected to the branch circuit equipment ground conductor (green).
- M. All receptacles installed in damp and wet locations shall be weather resistant.

3.2 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles (10% of devices):
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 10-A Load: A value of 5 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 - Procurement and Contracting Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. In general, disconnect switches and circuit breakers are indicated on the drawings, and it shall be the Electrical Contractor's responsibility to furnish and install all disconnect switches for equipment and motors furnished by them, and for equipment and motors furnished by others.
- B. Contractor shall furnish all equipment, materials, tools, labor and supervision necessary to install equipment as specified in this section and as called for on the drawings. All components necessary for a complete installation including, but not limited to fuses, fuse clips, channel strut support, lugs, etc. are to be included by the contractor.
- C. Types of switches and circuit breakers in this section include the following:
 - 1. Fusible and non-fusible disconnect switches.
 - 2. Elevator disconnect switches
 - 3. Motor rated toggle disconnect switches
 - 4. Plug fuse disconnect switches
 - 5. Enclosed circuit breakers
 - 6. Fuses

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical motor and circuit disconnect switches.
- B. UL Compliance and Labeling: Provide motor and circuit disconnect switches which have been UL listed and labeled.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub. No. KS 1.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.

- B. Product data: provide one submittal containing the following information:
 - 1. Manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.
 - b. Include manufacturer's maintenance information.
 - 2. Manufacturer's Warranty: Submit manufacturers standard warranty document.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE DISCONNECT SWITCHES

- A. Manufacturers:
 - 1. Schneider Electric/Square D (building standard)
- B. Fusible Switch: NEMA KS 1, Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Non-fusible Switch: NEMA KS 1, Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors. Provide for all 4-wire feeds.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open. Provide for all switches on the load side of a VFD and elevator disconnects.
- E. Disconnects installed indoors shall have NEMA 1 enclosures, disconnects installed outdoors or in wet locations shall have raintight NEMA 3R enclosures. Disconnects specifically identified by '4X' shall have a stainless steel NEMA 4X enclosure.
- F. Disconnects used for service entrance equipment shall be labeled for such use.

- G. Disconnects that are part of a photovoltaic system shall be listed for such use.
- H. Disconnect switches for elevators served from the emergency power system shall be furnished with a 50kA surge protective device.
- I. All disconnects shall be of the fuse type, except where drawings indicate non fuse type (NF).
- J. Safety switches in mechanical rooms shall be NEMA 3R type.

2.2 MOTOR RATED TOGGLE DISCONNECT SWITCHES

- A. Manufacturers:
 - 1. Schneider Electric/Square D (Basis of Design)
 - 2. ABB/GE Industrial Solutions
 - 3. Eaton
 - 4. Siemens
 - 5. Hubbell
 - 6. Pass & Seymour
- B. Description: Motor rated non-fused switch for ON-OFF control of single or three-phase motors and equipment where overload protection is not required. Square D class 2510, type K or equal.
 - 1. Compact construction.
 - 2. NEMA 1 enclosure or as noted with handle guard provision able to be locked in the open position.
 - 3. Two or three pole configurations, 600V rated.

2.3 PLUG FUSE DISCONNECT SWITCHES

- A. Manufacturers:
 - 1. Bussmann
- B. Description: Box cover switch and fuse holder for Fustat plug fuses.
 - 1. Bussmann type SSY, handy box mounted.
 - 2. 120V, single pole, 15A rated
 - 3. Plug fused sized for individual motor.

2.4 ENCLOSED CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.

- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with fully connected rating to meet available fault currents. No series rated devices.
1. Breakers 20A to 125A:
 - a. Thermal magnetic trip.
 2. Breakers 150A-225A: Electronic trip with true RMS sensing
 - a. Adjustable long-time pick-up setting
 - b. Adjustable long-time delay.
 - c. Adjustable instantaneous trip settings.
 - d. Adjustable short time pick-up settings with I²t delay.
 - e. Ground fault pick-up & delay where ground fault protection is indicated.
 - f. Local status indicator showing breaker status and trip log for last (5) trip events.
 - g. Trip unit shall include real time metering for voltage, current, power and frequency.
 3. Breakers 250A-700A: Electronic trip with true RMS sensing
 - a. Adjustable long-time pick-up setting
 - b. Adjustable long-time delay.
 - c. Adjustable instantaneous trip settings.
 - d. Adjustable short time pick-up settings with I²t delay.
 - e. Ground fault pick-up & delay where ground fault protection is indicated.
 - f. Local status indicator showing breaker status and trip log for last (5) trip events.
 4. Trip unit shall include real time metering for voltage, current, power and frequency. Breakers 800A and larger: Electronic trip with true RMS sensing
 - a. Adjustable long-time pick-up setting
 - b. Adjustable long-time delay.
 - c. Adjustable instantaneous trip settings.
 - d. Adjustable short time pick-up settings with I²t delay.
 - e. Ground fault pick-up & delay where ground fault protection is indicated.
 - f. Local status indicator showing breaker status and trip log for last (5) trip events.
 - g. Breakers 1200A or larger shall be provided with an energy reduction maintenance switch.
 - h. Trip unit shall include real time metering for voltage, current, power and frequency.
 5. Refer to the equipment schedules for special provisions for select circuit breakers including variations of the requirements noted above, ground fault trip, ground fault alarm, shunt-trip, and undervoltage trip..
 6. Ground fault protection:
 - a. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - b. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
- C. Breakers shall have removable lugs. Lugs shall be UL listed for copper/aluminum conductors. Breakers shall be UL listed for installation of mechanical screw type lugs.

- D. Enclosed circuit breakers installed indoors shall have NEMA 1 enclosures, enclosed circuit breakers installed outdoors or in wet locations shall have raintight NEMA 3R enclosures.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors. Provide for all 4-wire feeds.
 - 3. Permanent provision for locking in the open position,
- F. Enclosed circuit breakers used for service entrance equipment shall be labeled for such use.

2.5 FUSES

- A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time/current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and construction in accordance with published product information, and with industry standards and configurations.
- B. Main Service Feeders and Branch Circuits: For switch rating over 600 amperes: Hi-Cap, Type KRP-C with interrupting rating of 200,000 amperes RMS. For switch rating 600 amperes or less: Low peak current limiting fuses, Type LPN(S)-R, with interrupting rating of 200,000 amperes RMS.
- C. Motors Above One-half (1/2) Horsepower: For fuse rating 600 amperes or less, dual element time delay, Type FRN(S)-R, with interrupting rating of 200,000 amperes RMS. Size fuses per Article 430 of the National Electric Code.
- D. Motors One-half (1/2) Horsepower or Less: Single phase 150 volts or less, Fustat fuses for motor running protection sizes. Single phase or three phase over 150 volts, Fustron fuses for motor running protection, with interrupting rating of 100,000 RMS. Size fuses per Article 430 of the National Electric Code.
- E. Fuses for all feeders, branch circuits, motors and other equipment shall be selected in types and ratings in accordance with NEC to provide a coordinated system of overcurrent protection, thus in case of a fault or harmful overload, only the fuses nearest the fault or overload will open.
- F. Provide one spare set of three (3) of each size and type of fuse used on project.

PART 3 - EXECUTION

3.1 INSTALLATION OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Install disconnect switches as follows:
 - 1. Heavy Duty Switches. All applications including motors, feeders, service entrance, and equipment.
 - 2. Motor Rated Toggle Disconnect Switch. May be used for motors and equipment 30 Amps or less where fuse protection is not required. Applications include heat pumps, pumps and fans, where not downstream of a VFD,
 - 3. Plug Fuse Disconnect Switch. May be used for 120 Volt motors, 1/2hp or less including furnaces, circulation pumps, and exhaust fans.
 - 4. Enclosed Circuit Breakers: Where specifically indicated.
- C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.
- D. Install fuses in switches protecting equipment rated in accordance with nameplate maximum overcurrent protection noted on the equipment.
- E. Where a disconnect switch is installed downstream of a VFD, the disconnect switch shall be provided with make-before-break auxiliary contacts with control wires to the VFD to signal the VFD.
- F. Maintain all clearances required the by the National Electrical Code.
- G. Where NEMA 3R equipment is specified for use in interior locations, installation shall maintain the weatherproof listing of the equipment.

END OF SECTION 262816

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 RELATED WORK

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 260010 - Electrical General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. Provide lighting fixtures, accessories, labor and supervision necessary to install complete lighting system as required by the drawings and this section.
- B. Types of lighting fixtures in this section include the following:
 - 1. Solid State (LED)
 - 2. Exit Signs
 - 3. Emergency
 - 4. Exterior Luminaires

1.3 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to installation and construction in building lighting fixtures.
- B. NEMA Compliance: Comply with applicable requirements of NEMA standard publications pertaining to lighting equipment.
- C. Listings: Provide lighting fixtures which have been listed and labeled. Listing or labeling shall be by UL, ETL Intertek or other nationally recognized agency.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data: provide one submittal containing the following information:
 - 1. Manufacturer's data on interior and exterior lighting fixtures.
 - 2. Drawings: Submit fixture drawings in pdf form with separate sheet(s) for each fixture type arranged in alphabetical order. Include proposed options and accessories clearly indicated on each sheet.
 - a. Submittal shall indicate the specific lumen output and power consumption for each fixture type.
 - b. For fixtures requiring field assembly provide factory generated shop drawings indicating feed points, joint locations, and assembly instructions.

- c. Include driver product data for each fixture type.
- d. The pdf shall be book-marked by the fixture type. Submittal that is not bookmarked will be returned without review.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.
 - b. Include manufacturer's maintenance information.
 - c. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - 2. Startup and test reports: Submit reports immediately upon completion of tests.
 - 3. Manufacturer's Warranty: Submit manufacturers standard warranty document.
 - 4. Spare Parts.

1.6 WARRANTY

- A. Fixtures shall be guaranteed to be free from original defects in both material and workmanship for a period of five (5) years. This warranty shall become effective starting the date of project substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers shall be as listed in the light fixture schedule on the drawings.
- B. Basis of Design Product: The design for each luminaire is based on the product named and described in the light fixture schedule on the drawings. Provide either the named product or a comparable product by one of the equivalent manufacturers listed. Equivalent manufacturers shall match the basis of design product in both form and function. The Architect and Engineer have the final acceptance of equivalent products. Where equivalent products are not determined to match the basis of design, the basis of design product shall be provided at no additional cost to the Owner. Upon request, equivalent manufacturers shall submit lighting calculations and ies files to prove performance of product and samples for table top viewing.

2.2 SOLID STATE LIGHTING / LIGHT EMITTING DIODE (LED) LUMINAIRES

A. General:

1. Luminaire manufacturer shall have a minimum of five (5) years' experience in the manufacture and design of LED products and systems.
2. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers.

B. LED Warranty

1. Luminaire manufacturer provide a five (5) year written warranty, warranty shall start upon project substantial completion.

C. Replacement and Spares:

1. Manufacturer shall provide written guarantee of the following:
 - a. Manufacturer shall be able to provide compatible replacement parts that are designed to fit into original luminaire for ten (10) years.
 - b. Replacement LED array/module shall be within 3 MacAdam color ellipse, within 10% of lumen output, 7% of correlated color temperature (CCT) and equivalent distribution of original array/module.
 - c. Replacement LED array/module shall utilize equal to or less than amount of wattage of original array/module.
2. LED driver and array/module shall be replaceable in field.

D. Products and Components – Performance:

1. All LED components shall be mercury-free and lead-free.
2. LEDs shall comply with ANSI/NEMA/ANSI C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products. Color shall remain stable throughout the life of the light source.
3. LEDs shall comply with IESNA LM-80 – Standards for Lumen Maintenance of LED Lighting Products.
4. LEDs shall have a minimum rated source life of 50,000 hours under normal operating conditions or as noted on the lighting fixture schedule. LED “rated source life” is defined as the time when a minimum of 70% of initial lumen output remains, as defined by IESNA LM-70.
5. Luminaire assembly shall include a method of dissipating heat so as to not degrade life of source, electronic equipment, or lenses. LED luminaire housing shall be designed to transfer heat from the LED board to the outside environment. Luminaire housing shall have no negative impact on life of components. Upon request, manufacturer shall provide junction temperature limitations and test reports of installed LED in fixture.
6. Method of dissipating heat shall be passive, active cooling systems are not allowed.
7. High power LED luminaires shall be thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware.
8. LEDs shall be adequately protected from moisture or dust in interior applications.

9. For wet and damp use, LED-based luminaires themselves shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure. Such protection shall have no negative impact on rated life of source or components, or if so, such reductions shall be explicitly brought to the attention of the designer.
10. All hardwired connections to LED luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
11. Manufacturer shall provide Luminaire Efficacy (lm/W), total luminous flux (lumens), luminous intensity (candelas) chromaticity coordinates, CCT and CRI. Optical performance, polar diagrams, and relevant luminance and illuminance photometric data. Provide data in IES file format in accordance with IES LM-79-2008, based on test results from an independent Nationally Recognized Testing Laboratory. Provide information upon special request.

E. LED drivers shall meet the following requirements:

1. Drivers shall have a minimum efficiency of 85%.
2. Minimum/Maximum Ambient Temperature: -20°C/55°C interior locations, -40°C/55°C exterior locations,
3. Input Voltage: 120 to 277 ($\pm 10\%$) V or as scheduled.
4. Power Supplies: Class I or II output.
5. Dimming Type: 0-10V control with current source driver, current sinking drivers are not allowed.
6. Surge Protection for exterior fixtures: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
7. Power Factor (PF): ≥ 0.90 .
8. Total Harmonic Distortion (THD): $\leq 20\%$.
9. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
10. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
11. Mean Time Between Failure (MTBF): 100,000 hours based on 90% survival.

2.3 EXIT SIGNS

- A. Housing to be per light fixture schedule (thermoplastic, edge lit or cast aluminum) for wall, end or ceiling mounting. Illumination to be by long life, low watt LED lamps. Battery, where specified, to be maintenance free, sealed nickel-cadmium type and shall operate sign for 90 minutes after loss of power.

2.4 EMERGENCY FIXTURES

- A. Housing and lamping per light fixture schedule. Self-contained complying with UL 924. Battery to be premium grade, lithium-ion phosphate or nickel cadmium, maintenance free battery and shall operate sign for 90 minutes after loss of power.

PART 3 - EXECUTION

3.1 INSTALLATION OF INTERIOR LIGHTING FIXTURES

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of the National Electric Code (NEC), NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. All low-voltage luminaires using remote drivers or power supplies shall be installed as follows:
 - 1. Installation shall be in compliance with the manufacturer's instructions including distance limitations.
 - 2. Remote drivers and power supplies shall be located in accessible locations and clearly noted on as-built plans. Where plywood is used for power supply mounting, plywood shall be UL Listed fire resistant.
 - 3. Unless specifically noted "Class 2", all low-voltage wiring between remote drivers or power supplies and luminaires shall be considered Class 1 and installed in accordance with NEC Article 725. Wiring shall be 600V rated and installed in conduit.
 - 4. All remote drivers and power supplies not specifically labeled "Class 2" on the power supply housing shall be installed in a ventilated metal enclosure. Where the power supply includes cooling fan or convection cooling, ventilation openings in enclosure shall be provided to not impede power supply cooling.
- C. Coordinate with other electrical work as appropriate to properly interface installation of interior lighting fixtures with other work.
- D. Coordinate fixture location with reflected ceiling plan.
- E. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box. Where fluorescent fixture housings are connected together, use 90 deg.C wire for branch circuit feed through fixture channels.
- F. All fixtures shall be grounded. All lamp sockets shall be wired so that the outer shell is connected to the neutral grounded conductor.
- G. Fixtures recessed in furred ceiling shall be installed so that they can be removed from below the ceiling.
- H. Luminaires located in suspended ceilings shall be connected with a maximum 6 foot length of flexible metal conduit and building wire.
- I. Housing, trim, and lens frame shall be true, straight and parallel to each adjacent fixtures and features.

- J. Contractor shall include all materials and labor necessary for the final aiming and adjusting of adjustable light fixtures. Adjustment of light fixtures may be required to occur after sunset at a time designated by the Engineer.
- K. Round fixtures or fixtures smaller than the ceiling grid shall have at least two (2) 3/4 inch (19 mm) metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.
- L. Troffer, recessed and semi-recessed fixtures shall be installed at a minimum per the manufacturer's instructions and the requirements below. Fixtures shall not be supported directly on the ceiling material. Support fixtures with metal bar hangers or strut channels attached to the ceiling tees. Coordinate with Ceiling Contractor to ensure ceiling tees can support the weight of the light fixtures.
- M. Suspended Linear or Pendant mounted fixtures shall be independently supported from the building structure by wires, straps or rods.
- N. Fixture whips shall be in accordance with section 260533 Raceway and Boxes for Electrical Systems.

END OF SECTION 265000

SECTION 270010 - COMMUNICATIONS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL

- A. Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. This section applies to the installation and implementation of a Structured Cabling System designed to support a wide range of communication services. This includes, but is not limited to, voice, data, audio, video, security systems, and multimedia applications. The Structured Cabling System shall be designed, installed, and tested in accordance with the latest industry standards to ensure optimal performance, reliability, and future scalability.
- B. The Structured Cabling System shall include all materials, equipment, and labor necessary to provide a complete, fully functional communication system. The scope of work includes, but is not limited to, the following:
 - 1. Register the project with the structured cabling plant manufacturer, if applicable, to ensure compliance with product and manufacturer standards.
 - 2. Furnish, install, and terminate all cables, including voice, data, and fiber, as specified in the project drawings, with all required, housings, enclosures, connectors, wall plates, jacks, patch panels, and patch cords.
 - 3. Furnish and install all necessary cabinets, racks, wire basket tray, ladder racks, and other structural components to support the system and ensure proper cable management.
 - 4. Furnish any additional materials required to complete the installation and ensure the system is fully operational.
 - 5. Perform certification and performance testing of all cabling and components, ensuring compliance with ANSI and other applicable industry standards.
 - 6. Provide the owner with the following: test results, organized by closet and workstation ID, and as-built documentation, including a labeled map showing the structured cabling plant within the building(s), with one electronic copy and two hard copies.
 - 7. Adhere to and comply with all requirements specified in the Contractor Agreement for the structured cabling plant manufacturer, ensuring the system meets performance standards.
 - 8. Provide the owner with training on system operation and maintenance, along with testing and maintenance documentation to ensure ongoing functionality.
- C. All work shall be performed by skilled workers in their respective trades who meet the Approved Contractor requirements, in a neat and professional manner, and in accordance with the highest standards to ensure a properly functioning Structured Cabling System.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
1. National Electrical Code
 2. Local Electrical Code
 3. National Fire Protection Association
 4. National Electrical Manufacturers Association
 5. Standards of Institute of Electrical and Electronic Engineers
 6. Applicable Building Codes
 7. Occupational Safety and Health Act
 8. Iowa Administrative Codes
 9. ANSI TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 10. ANSI TIA-526-14-C Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 11. ANSI TIA-568-D.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
 12. ANSI TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 13. ANSI TIA-568-C.3 Optical Fiber Cabling Components Standard
 14. ANSI TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
 15. ANSI TIA-569-D Telecommunications Pathways and Spaces
 16. ANSI TIA-570-C Residential Telecommunications Infrastructure Standard
 17. ANSI TIA-598-D Optical Fiber Cable Color Coding
 18. ANSI TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure
 19. ANSI TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 20. ANSI TIA-758-B Customer-owned Outside Plant Telecommunications Infrastructure Standard
 21. National Fire Protection Agency (NFPA - 70), National Electrical Code (NEC)
- B. All Contractors shall familiarize themselves with all codes and standards applicable to their work. No extra compensation will be allowed for corrections or changes in the work required due to failure to comply with the applicable codes and standards. Where two or more codes or standards are in conflict, that requiring the highest order of professionalism shall take precedence, but such questions shall be referred to Design Professional for final decision.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the local serving utility companies and shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Secure all required permits and pay for all inspections required in connection with the telecommunication systems work. Contractor shall post all bonds and obtain all licenses required by the State, City, County, and Federal Agencies.

1.5 DRAWINGS

- A. Drawings for the work are in part diagrammatic, and are intended to convey the scope of the work and to indicate in general the location of equipment.
- B. Contractor shall layout their own work and shall be responsible for determining the exact quantities and locations for equipment.
- C. Contractor shall take own field measurements for verifying locations and dimensions; scaling of the drawings will not be sufficient for laying out the work.
- D. Because of the scale of the drawings, certain basic items for a complete installation are not shown, but where such items are required by code (or referenced standards) where they are required for proper installation and operation of the work, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact locations of all existing services prior to beginning work in that area.
- B. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- C. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to become familiar with the conditions of the site which will affect the work and shall verify points of connection with utilities and/or existing system wiring.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be Contractor's responsibility to schedule and coordinate work with the schedule of General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building. The Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.

- C. Drawings and specifications are intended to be complimentary. Any work shown in either of them, whether in the other or not, shall be executed according to the true intent and meaning thereof, the same as if set forth in all. Conflicts between the drawings and the specifications, or between the requirements set forth for the various contractors, shall be called to the attention of the Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by Design Professional and their decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting, plaster, etc., until the project is substantially completed. Damage from rust, paint, scratches, etc., shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the Painting Contractor, but this shall not relieve Contractor of the responsibility for checking to assure that adequate protection is being provided.
- F. Where the final installation or connection of equipment in the building requires Contractor to work in areas previously finished by Owner, the Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Contractor shall be responsible for patching and refinishing of such areas which may be damaged in this respect.
- G. Where two or more specified items/systems in the specifications and/or the drawings are in conflict, that requiring the highest order of professionalism and the most financially expensive products shall take precedence. Such questions shall be referred to the Design Professional for final decision.

1.9 OPENINGS, CUTTING AND PATCHING

- A. Refer to Division 1 for additional cutting and patching information. Refer to Section 078400 – Firestopping and Section 079200 – Joint Sealants for additional information.
- B. Conduits and sleeves passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and conduit or sleeve shall be sealed with UL listed intumescent fire barrier material equivalent to rating of wall/floor. Where conduit or sleeves pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk.
- C. Existing Structure:
 - 1. Contractor shall provide cutting, lintels and patching, and patch painting in the existing structure, as required for the installation of their work, and shall furnish lintels and supports as required for openings.
 - 2. Cutting of structural support members will not be permitted without prior approval of the Design Professional. Extent of cutting shall be minimized; use core drills, power saws or other machines which will provide neat, minimum openings.

3. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.
- D. Conduits and wireways passing through all fire or smoke rated floors, roofs, walls, and partitions shall be provided with firestopping. Space between wall/floor and conduits, sleeves and/or wireways, shall be sealed with UL listed intumescent fire barrier material equivalent to rating of wall/floor. Where conduits, sleeves and/or wireways pass through floors, roofs, walls and partitions that are not fire or smoke rated, penetrations shall be sealed with grout or caulk.
- E. For exterior walls below grade, sleeves shall be cast iron. Space between sleeve and conduit shall be sealed with modular mechanical rubber links tightened with bolts as made by Thunderline Corporation, Wayne, Michigan 48184. Waterproofing of conduit penetrations in exterior walls shall be coordinated with waterproofing contractor.

1.10 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall originate from a reputable manufacturer regularly involved in producing the specified item, unless expressly authorized by the Design Professional in writing. When multiple units of the same item are necessary, they shall be supplied by the same manufacturer, unless explicitly stated otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot address minute components individually, such as parts, controls, devices, etc., necessary for the specified equipment's performance and functionality or to fulfill the equipment guarantees. When needed, such components must be provided as part of the equipment, regardless of specific mention.

1.11 SUBSTITUTIONS

- A. To seek approval for the use of unspecified equipment, Bidding Contractors (not equipment suppliers, manufacturers, etc.) shall submit written requests to the Design Professional at least 10 days before the bid due date. Requests must clearly describe the equipment requiring approval, including all necessary data demonstrating its capacities, features, and performance equivalency, along with a cost comparison between the specified equipment and the proposed alternative. If deemed acceptable, the Design Professional will approve it through an addendum. The Design Professional will, under no circumstances, be obligated to validate whether a proposed substitution item is of equal quality to the specified item.
- B. Where substitutions are approved, the Contractor assumes full responsibility for the physical dimensions and any resulting changes. This responsibility encompasses all additional work required by other trades due to the substitution.

1.12 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer's type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the drawing schedules, are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers, who do not submit prior to bidding, run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of Contractor and/or the manufacturer.
- C. If Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions, operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.
- D. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.13 APPROVED CONTRACTORS

- A. **MANUFACTURER CERTIFICATION:** Contractor shall be a manufacturer certified installer for the structured cabling plant. A copy of the current annual manufacturer certification shall be provided with 27 0010 submittals. Contractor is responsible for professionalism and installation practices in accordance with the manufacturer requirements and shall be authorized to provide an extended Manufacturer's Product Warranty with their installation. The specific warranty program that is acceptable for each solution is listed with the connectivity solution in specification section 271100 Communications Cabling and Equipment. Contractors shall provide proof upon request that they have maintained the Manufacturers Certification in good standing prior to the project bid date. Temporary or short term certifications (less than the standard 12 month annual certification described above) or case-by-case certifications are not acceptable.

- B. **CONTRACTOR CERTIFICATION:** Contractor shall meet one of the following two paragraphs and provide appropriate documentation in the 270010 submittals:
1. Contractor shall have BICSI Registered Installers and Technicians on staff and assign them to this project. The project shall be staffed at all times by Installers and Technicians who, in the role of lead craft-persons, will be able to provide leadership and technical resources for the remaining craft-persons on the project. A minimum of 30 percent of personnel shall be BICSI registered telecommunications installers. Of that number 15 percent shall be registered at the Technician Level, at least 40 percent shall be registered at the Installer Level 2, and the balance shall be registered at the Installer Level 1. Contractor shall provide BICSI certifications showing employee name, level, and expiration date. BICSI certificate for the highest level attained shall be submitted.
 2. Contractor shall have employees on staff and assigned to the project that are currently indentured in or have successfully completed the IBEW/NECA three-year Telecommunications Installer/Technician registered apprenticeship program. Contractor shall maintain a ratio of 1 Technician to 1 indentured Apprentice. Contractor shall provide documentation verifying the indentured status of Apprentices, and the Department of Labor Certificates of Completion for the Installer/Technicians.
- C. Contractor pulling the telecommunications cabling (if different from the prime Telecommunications Contractor) shall meet all the same BICSI or IBEW/NECA requirements, and requirements of this specification, as the prime Telecommunications Contractor.
- D. The Division 27 Contractor shall submit copies of the Contractor Certifications under Section 270010 (BICSI, AVIXA, or IBEW/NECA Certifications) to demonstrate compliance with the specifications. See the Approved Contractors paragraph for details.
- E. The Division 27 Contractor shall submit the Manufacturer Certification under Section 270010. Refer to the Approved Contractors paragraph in this section for details, and to Section 271500, Communications Horizontal Cabling and Equipment, for further requirements.
- F. The Manufacturer's catalog cuts and System Shop Drawings for all Division 27 sections will not be opened or reviewed by the Design Professional until the Division 27 Contractor Certifications and Division 27 Manufacturer Certifications have been received and deemed acceptable.

1.14 SUBMITTALS

- A. Contractor shall furnish, to the Design Professional, complete sets of submittals. Contractor shall review and sign submittals before submitting. Contractor shall provide submittals via electronic process (.PDF format) unless otherwise instructed. Refer to Division 01 specifications for additional requirements.

- B. Submittals shall be bound into sets per specification section (not division). The content of the submittal shall cover related items for a complete system as much as practical and items shall be identified with symbols or "plan marks" used on drawings whenever possible. Incomplete, piecemeal or unbound submittals will be rejected.
- C. Each submittal shall include a cover sheet providing the Approved Contractors company name, address, phone number and contact person (person to contact if there are questions about the submittal). The cover sheet shall also have adequate white space for the design professional review stamp as well as up-stream contractor stamps. The company providing the submittal shall be the same as that which meets the APPROVED CONTRACTOR requirements paragraph found later in this specification section (submittals without this identifying contractor information on the cover page will be rejected to ensure the Approved Contractor process is being followed).
- D. Design Professional will review submittals solely to assist contractors in correctly interpreting the plans and specifications.
- E. Contract requirements cannot be changed by submittals. Contract documents remain in force even if equipment is submitted which differs from contract drawings and specifications and that submittal is stamped as reviewed (or any other stamp verbiage).
- F. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- G. After award of contract, the contractor shall provide a completed submittal schedule including dates that the submittals will be to the Design Professional for review.
- H. Submittals shall be sorted and separately identified per specification section.

1.15 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to the Design Professional in duplicate upon completion of the job. Refer to Division 01 specifications for additional information.
- B. Submit manuals shall be bound in a three ring hard backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
COMMUNICATIONS SYSTEMS
(PROJECT NAME)
(LOCATION)
(DATE)
SUBMITTED BY
(NAME, ADDRESS AND PHONE NUMBER OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Each section shall contain the following information for equipment furnished under this contract:
1. Equipment and system warranties and guarantees.
 2. Installation instructions.
 3. Operating instructions.
 4. Maintenance instructions.
 5. Spare parts identification and ordering list.
 6. Local service organization, address, contact and phone number.
 7. Submittals with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.

1.16 TESTS AND DEMONSTRATIONS

- A. All systems shall be tested by Contractor and placed in proper working order prior to demonstrating systems to Owner.

1.17 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the communications installation, the Contractor shall provide to Owner, or their designated representatives, all comprehensive training on essential features and functions of all systems installed and shall instruct Owner in the proper operation and maintenance of such systems.
1. Provide adequate notice to Owner as to when instruction will be conducted so appropriate personnel can be present.
 2. Prepare the instruction format for a minimum of four Owner Representatives.
- B. Equipment training:
1. Manufacturer's representatives shall provide instruction on each major piece of equipment. Contractor shall provide instruction on all other equipment.
 2. Training sessions shall use the printed installation, operation and maintenance instruction materials included in the O&M manuals and emphasize preventative maintenance and safe operating procedures.
 3. Training shall be performed by qualified factory trained technicians.
 4. Contractor shall attend all sessions performed by the manufacturer's representative and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
 5. Equipment training shall occur as soon as possible after start-up of the equipment and shall include hands-on operation. Training shall be provided for equipment listed in the table below.
- C. Each Contractor shall submit a certificate (in the project closeout submittals), signed by Owner stating the date, time and persons instructed and that the instruction has been completed to Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that the contractor has demonstrated the hereafter listed systems to Owner's representatives in accordance with the Contract documents and that the instruction has been completed to the Owner's satisfaction.

- A. Project:
- B. System(s):
- C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

- D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

- E. Acknowledgement of demonstration:

Contractor's Representative:

Signature

Date

Owner's Representative:

Signature

Date

1.18 QUALITY ASSURANCE

- A. Contractor shall be a company specializing in communication cable and/or accessories with a minimum of five years documented experience in installation of cable and/or accessories similar to those specified below.

1.19 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.
 - b. All Division 27 systems, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 28 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.20 CHANGES IN THE WORK

- A. A Contract Change Order is a written order to Contractor signed by Owner and Contractor, issued after the execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Contract Change Order.
- B. Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, with the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Contract Change Order and shall be performed under the applicable conditions of the Contract Documents.

- C. The cost or credit to Owner resulting from a change in the Work shall be determined by mutual acceptance of a lump sum properly itemized and supported by sufficient substantial data to permit evaluation. Change Orders shall be submitted with each item listed individually with a material cost and labor unit extension. Overhead and profit, as mutually agreed upon between Owner and Contractor shall be added to material and labor cost figures.
- D. It shall be the responsibility of Contractor before proceeding with any change to satisfy their self that the change has been properly authorized on behalf of Owner.

1.21 GROUNDING AND BONDING OF SYSTEMS

- A. All low voltage systems shall be subject to the Grounding and Bonding for Communication Systems specification section 270526. For those systems which may require a specialized sub-contractor, the sub-contractor providing and installing systems shall also be responsible for grounding and bonding per this specification.

1.22 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by Owner.
- B. When all the work is complete Contractor shall thoroughly clean all material and equipment installed as a part of this contract and leave all equipment and material in new condition.
- C. Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

END OF SECTION 270010

SECTION 270528 – CABLE TRAY PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements, Section 260010 - Electrical General Provisions, Section 260500 – Common Work Results for Electrical, Section 260529 – Hangers and Supports for Electrical Systems, Section 260533 – Raceways and boxes for Electrical Systems, Section 270010 – Communications General Provisions are applicable to work required of this section.
- B. This section identifies the specifications pertaining to mechanical support systems designed for communication systems infrastructure; including but not limited to ladder, ventilated trough, ventilated channel, solid bottom, and wire basket.

1.2 DESCRIPTION OF WORK

- A. The work included under this specification encompasses all tasks associated with supplying labor, equipment, materials, and resources and conducting all essential activities to finalize the installation of primary cable tray pathways for communication systems in accordance with the provided specifications and drawings. The contractor is responsible for furnishing and setting up all necessary materials to establish a comprehensive system, regardless of whether they are explicitly detailed in the technical specifications.
- B. Communication systems consist of but are not limited to:
 - 1. Data
 - 2. Voice
 - 3. Video
 - 4. Audio
 - 5. Security
 - 6. Nurse Call
 - 7. Distributed Voice Paging/Intercom
 - 8. Sound Masking
 - 9. Engineer designated systems.
- C. Ensure that all cable trays intended for communication systems are integrated with other communication cable pathways, creating a seamless pathway system extending from the telecom room to the designated work area outlet or technology device, as specified in the construction plans.

1.3 CODES AND STANDARDS

A. Installation requirements are found in the following standards.

1. ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-569 Telecommunications Pathways and Spaces
3. ANSI/TIA-606 Administration Standard for the Telecommunications Infrastructure
4. ANSI/NFPA 70/392 – National Electric Code – Cable Trays
5. ANSI/NFPA 70/770 – National Electric Code – Optical Fiber Cables and Raceways
6. ASI/NFPA 70/250 - National Electric Code – Ground and Bonding
7. ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
9. BICSI Electronic Safety and Security Reference Manual (ESSDRM), current edition
10. BICSI Information Transport Systems Installation Methods Manual (ITSIM), current edition
11. BICSI Network Design Reference Manual (NDRM), current edition
12. BICSI Telecommunications Distribution Methods Manual (TDMM), current edition
13. BICSI Wireless Design Reference Manual (WDRM), current edition
14. NEMA VE 2 Cable Tray Installation Guidelines, current edition
15. NEMA VE 1 Metal Cable Tray Systems, current edition

1.4 SUBMITTALS

A. Refer to Division 01 Submittal requirements.

B. Product data: provide one submittal containing the following information:

1. Drawings that depict wire basket cable tray components and related items such as connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps, and hold-down plates. Ensure that these drawings accurately represent the scaled components, and include information regarding wire basket cable tray dimensions, support locations, and finishes.
2. Manufacturer-supplied data regarding the wire basket cable tray system, encompassing details such as types, materials, finishes, and inner depths, among other relevant specifications.
3. Manufacturer's Installation Guidelines: Provide the application conditions and usage limitations as determined by the product testing agency referenced. Additionally, include instructions for storing, handling, protecting, inspecting, preparing, and installing the product.

1.5 CLOSEOUT DOCUMENTS

A. Refer to Division 01 Closeout requirements.

B. Provide closeout items containing the following:

1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.
 - b. Include manufacturer's maintenance information.

c. Operation and Maintenance Data

2. Startup and test reports: Submit reports immediately upon completion of tests.
3. Manufacturer's Warranty: Submit manufacturers standard warranty document.

1.6 WORK BY OTHERS

A. In general, the following is provided or is of note:

1. Electrical Contractor will provide field conduit paths for use by Division 27.

1.7 FIRESTOPPING

- A. Contractor shall be responsible for fire stopping all conduit sleeves (internally only) and cable tray where required to maintain integrity of fire and/or smoke walls. The Contractor shall review architectural drawings to determine which walls have a fire and/or smoke rating. Any rating other than "non-rated" shall constitute a wall that requires fire stopping in all penetrations/openings.
- B. Refer to Section 270010 in Openings, Cutting, and Patching for additional requirements and instructions.

PART 2 - PRODUCTS

2.1 WIRE BASKET HORIZONTAL CABLE MANAGEMENT

- A. Wire basket cable tray shall be provided and installed (generally outside of telecom) as shown on the plans.
- B. Acceptable Manufacturers are:
 1. nVent CADDY (WBT)
 2. Eaton, Flextray Cable Management
 3. Legrand Cablofil, Wire Mesh Cable Tray
 4. MonoSystems, Mono-Mesh Wire Basket Cable Tray
 5. Engineer approved equal.
- C. Additional Wire Basket Requirements:
 1. All wire basket and hardware shall be galvanized (no other coatings unless noted otherwise) applied after product fabrication. This is to ensure a product that is made of an electrically conductive material for grounding purposes.
 2. In order for a system to be approved as an equipment ground conductor, all splicing assemblies shall be UL Classified or CSA approved as an equipment ground conductor. When using powder coated wire mesh cable tray as an equipment ground conductor, the paint must be completely removed at all contact points of splice/ground bolt attachments.

3. It is the responsibility of the contractor installing the wire basket tray to coordinate the route indicated on the construction drawings with all other trades. Intersecting mechanical, fire alarm, or electrical systems shall not obstruct the fill ratio of the specified wire basket tray in any way.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The installation notes apply to all cable tray types noted within these specifications and on the construction drawings.
- B. Install in accordance with the manufacturer's installation instructions and recommendations, using the manufacturer's recommended fittings and accessories for system support, splices, tees, elbows, bends, intersections, and all transitions up, down, and around obstructions.
- C. Install as a complete system as indicated on the drawings.
- D. Install as a complete system to ensure electrical continuity of the system and adequate support for the cables. Bond to make electrically continuous.
- E. Where physical separation is necessary, cables shall be mechanically supported over the separation by alternate means (including hangers, clips, brackets, hooks, distribution rings, etc.). The ends of the cable tray and rack shall be electrically bonded together over each separation.
- F. Coordinate with design professional the acceptable alternate means for the project.
- G. The Div.27 contractor shall bond the cable tray to the Telecommunications Grounding busbars in the telecommunications room.
- H. Whenever possible the Contractor shall continue the basket around corners and changes in elevation by applying the factory instructions for cutting and bending the material rather than stopping the material, forcing the cable to jump from one installation to the other.
- I. The Contractor shall only cut the material with manufacturer approved cutters which leave a square edge, rather than bolt cutters which leave a sharp edge that can damage cables and severely injure installers or the Owner in the future.
- J. All fittings shall be field formed from straight sections in accordance with manufacturer's instructions.
- K. See construction drawings and details for Trapeze hangers as the typical wire basket cable tray support. The following methods are acceptable when Engineer approved.
 1. Center support hangers
 2. Wall brackets
 3. Engineer approved equal.

- L. Trapeze hangers or center support hangers shall be supported by ¼" inch or 3/8" inch diameter rods.
- M. Special accessories shall be furnished as required to protect, support, and install a wire basket cable tray system.
- N. Wire basket is shown in part diagrammatically on the plans. Conduit sleeves are shown passing through walls with a stub symbol on each end to represent what shall be installed.
- O. The Contractor shall install the wire basket at and to the intended locations shown on the plans.
 - 1. The maximum air gap between wire basket and a conduit sleeve passing through a wall horizontally shall be one foot (12").
 - 2. The maximum air gap between wire basket and the cable destination vertically shall be two feet (24").
- P. Support cable tray and cable rack at splices, tees, elbows, bends, intersections, transitions and per manufacturers recommendation. The supporting mechanisms shall be sufficiently spaced to support the weight of the cable trays and racks for their maximum capacity rating.
- Q. Route cable tray parallel and perpendicular to walls and ceiling.
- R. Support cable tray from overhead. Do not use wall support brackets if possible.
- S. Provide pull line in cable trays after 100% completion of cable installation.

END OF SECTION 270528

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SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 270010 - Communications General Provisions, 270526 - Grounding and Bonding for Communications Systems, 271313 - Communications Copper Backbone Cabling, 271323 - Communications Optical Fiber Backbone Cabling, 271500 - Communications Horizontal Cabling and Connectivity, 271533 - Communication Coaxial Horizontal Cabling, are applicable to work required of this section.

1.2 SCOPE OF WORK

- A. Furnish and install all materials, equipment and labels required as shown on the Drawings, Schedules and as specified.
- B. It is the intent of the Specifications, Drawings and Schedules that all labels be legible and provided in locations which are readily visible.
- C. Only those items affected by the installation of the project shall be labeled unless otherwise indicated.

1.3 STANDARDS

- A. Unless otherwise noted, all labels at distribution frames shall follow the color-coding scheme identified in ANSI/TIA/EIA 606 "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings".

1.4 DRAWINGS AND SPECIFICATIONS

- A. The Contractor shall keep a detailed up-to-date record of the label information and placement of all labels installed as specified herein.

1.5 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Documentation on labeling equipment.
 - 2. Example of printed labels.

1.6 CLEANING

- A. The Contractor shall clean all surfaces prior to the attachment of labels. Follow the manufacturer's recommendations for cleaning.
- B. The Contractor shall follow the manufacturer's recommendations for affixing labels.

1.7 ADDITIONAL IDENTIFICATION AND LABELING REQUIREMENTS

- A. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; pre-numbered plastic-coated type with clear plastic self-adhesive cover flap; numbered to show cable identification. Install within 6" of cable end.
- B. All field device labeling shall match the telecom room labeling for the corresponding cable.
- C. Jacks shall be numbered sequentially on the patch panel field, beginning at the top left, working across the row to the right, then down to the next row, etc.

PART 2 - PRODUCTS

2.1 LABELING EQUIPMENT AND CABLE LABELS

- A. Acceptable Manufacturers:
 - 1. Brady
 - 2. Brother
 - 3. DYMO
 - 4. Approved Equal

PART 3 - EXECUTION

3.1 SPACES

- A. Item: Telecommunications Room (TR). The TR has been pre-assigned and should be labeled by the contractor in a visible location as entering the space with minimum 2" high black on orange machine printed labels.

Example: TR-B

3.2 CABLING

3.02.1 Copper Cabling

- A. Item: Building Copper cable (BC). The BC is an interior multi-pair copper riser cable extending from the MTR to TR.
1. Label Location:
 - a. On the cable at both ends, near the hardware on which the cable is terminated.
 2. Label Information:
 - a. The Cable identifier is the letters BC followed by the cable number (2 numeric characters) and the Cable Pair Count (4 numeric characters) and the identifying telecommunicate room letter. Identify both the beginning and end count. The Cable identifier is unique to the building. The building copper cable identifier shall be assigned by the Contractor and recorded on the Communications Systems Identification Record document under the heading Building Copper.
 3. Method:
 - a. Black on white wire wrap machine printed label.
 4. Format:
 - a. All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One-line centered formatted text. Use dash as delimiter.
 5. Example: BC01-0001-0100-A
- B. Item: Horizontal Copper Cable. The Horizontal Copper Cable extends from the MTR or TR to any field side location requiring voice or data service within the defined serving boundaries of the said MTR or TR.
1. Label Location:
 - a. On the cable at both ends, near the hardware on which the cable is terminated.
 2. Label Information:
 - a. The Cable identifier is the letters (TR) followed by the serving TR identification letter and the 3 numeric characters field assigned by the Telecom Contractor during installation. The Cable identifier is unique to the TR. The Horizontal Copper Cable shall be recorded on the Communications Systems Identification Record document under the heading Jack ID. (see end of section)
 3. Method:
 - a. Black on white wire wrap machine printed label.
 4. Format:
 - a. All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One-line centered formatted text. Use dash as delimiter.

5. Example: TR-A-001

- C. Item: Patch Cables (data). The patch cables are used to connect data services to the user service locations and are plugged into the electronics or patch panels at the other end of the cable.

1. Label Location:

- a. On the end of the patch cable at the plug of both ends.

2. Label Information:

- a. Patch cable identifier (4 numeric characters). The patch cable identifier is sequential. The sequence is unique to the TR. The patch cable identifier shall begin with 0001 and end with the number corresponding to the quantity of jumpers installed in the room. The patch cable identifier shall be assigned by the Contractor and recorded on the Communications Systems Identification Record document under the heading "Data Patch Cable Identifier" provided for each Telecommunication room. (see end of section)

3. Method:

- a. Black on white machine printed wire wrap labels.

4. Format:

- a. The font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One line format.

5. Example: 0001

- D. Item: Patch Cables (voice). The patch cables are used to connect voice services to the user service locations and are plugged into the electronics or patch panels at the other end of the cable.

1. Label Location:

- a. On the end of the patch cable at the plug of both ends.

2. Label Information:

- a. Patch cable identifier (Alpha characters). The patch cable identifier is sequential. The sequence is unique to TR. The patch cable identifier shall begin with the letter A and end with the letter corresponding to the quantity of patch cables installed in the room. When Z is reached. The sequence will start over again with double alpha characters. (AA) The patch cable identifier shall be assigned by the Contractor and recorded on the Communications Systems Identification Record document under the heading "Voice Patch Cable Identifier" provided for each Telecommunication room. (see end of section)

3. Method:

- a. Black on white machine printed wire wrap labels.

4. Format:
 - a. The font shall be all Caps and as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One line format.
5. Example: A to Z after Z follow with AA to ZZ.

3.3 TERMINATION HARDWARE

3.03.1 Copper Termination Hardware

- A. Item: Outlet faceplate. The outlet faceplate is typically a 2-port or 4-port faceplate.
 1. Label Location:
 - a. On the top of the faceplate in the outlet location window and behind the clear plastic window.
 2. Label Information:
 - a. Outlet location number (8 alpha and numeric characters). The information shall match the outlet location number assigned by the contractor during installation. Outlet numbers are unique to the serving telecommunication room. Each outlet/jack number assigned by the Contractor and the room the jack is installed to shall be recorded on the Communications Systems Identification Record document under the heading Jack Identification and Jack Room Location.
 3. Method:
 - a. Manufacturer's white paper inserts. Print the information on an adhesive label and affix the label to the paper insert. Labels shall not be affixed to the clear plastic window. The orientation of the text on the label for the 2-port faceplates shall match the 4-port faceplates. Use only machine printed labels sized for purpose.
 4. Format:
 - a. Font should be sized to fill the area of the strip. The font should be Helvetica or equal and bold. One line format.
 5. Example: TR-X-XXX
- B. Item: Horizontal Copper Cable Patch Panels. The patch panel for horizontal copper cable is in the MTR or TR and installed in the equipment rack in pre-assigned rack units. The patch panel provides a connection point for voice and data service in the MTR or TR to any field side location within the defined serving boundaries of the said MTR or TR.
 1. Label Location:
 - a. In the manufacturers designated port label location.

2. Label Information:
 - a. Outlet location number (8 alpha and numeric characters). The information shall match the outlet location number assigned by the contractor during installation. Outlet numbers are unique to the serving telecommunication room. Each outlet/jack number assigned by the Contractor and the room the jack is installed to shall be recorded on the Communications Systems Identification Record document under the heading Jack Identification and Jack Room Location.
3. Method:
 - a. Black on white machine printed manufacture patch panel labels.
4. Format:
 - a. Font shall be sized to be readable, fitting all characters required within the manufacture provided area. The font should be Helvetica or equal and bold. One line format.
5. Example: TR-A-001

3.4 EQUIPMENT AND EQUIPMENT RACKS

- A. Item: Data Racks. The data racks are typically 19" free-standing or wall-mounted racks or cabinets.
 1. Label Location:
 - a. Top front and back cross bars of each data rack.
 2. Label Information:
 - a. The data rack identifier is the letters (DR) followed by the rack number (2 numeric characters). Start numbering from the front of the equipment rack, left to right. The equipment rack label information is shown on the drawing details. The equipment rack identifier is unique to the room.
 3. Method:
 - a. Machine printed 2.25" W x 1.25" H minimum component labels.
 4. Format:
 - a. All capital letters. The font should be sized to fill the label space with the information. The font should be Helvetica or equal and bold. One line format.
 5. Example: DR01

3.5 GROUNDING AND BONDING

- A. Item: Equipment bonding conductor (EBC). The equipment bonding conductor (EBC) bonds the TMGB and TGB to other cable tray within or outside the telecommunication room, data racks, and other miscellaneous metallic items, including electronic equipment.
1. Label Location:
 - a. On the conductor at each end and at each break in the insulation (for connection to another conductor or a busbar). The label shall be placed near the end busbar or the break in the insulation, whichever applies.
 2. Label Information:
 - a. The letters EBC followed by the sequence number (3 numerical characters). The sequence number shall be unique to the telecommunications room. The contractor shall assign the numbers as necessary to accomplish the installation.
 3. Method:
 - a. Black on white machine printed wire wrap Label. .50" W x .375" H.
 4. Format:
 - a. All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. One line format.
 5. Example: EBC-001

PART 4 - COMMUNICATIONS SYSTEMS IDENTIFICATION RECORD

- A. The following example document illustrates the information that shall be tracked during the construction project by the communications contractor. The contractor may use the format of this example document or utilize their own formatted document. The tracked information shall be turned over to the owner at the completion of the project.

Project: _____

Building: _____

Contractor Company: _____

Technician: _____

Date: _____

Telecommunication Room: M/TR-_____ Rm #: _____

Only note the Patch cable ID on the same row of the Jack ID that the patch cable was connected to.

Jack ID	Jack Rm. Loc.	Data Patch Cable ID	Voice Patch Cable ID
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			
TR- -			

END OF SECTION 270553

SECTION 271200 - COMMUNICATIONS TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.1 GENERAL

- A. Refer to Division 00 – Procurement, Contracting and Warranty Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 PURPOSE

- A. The purpose of the testing is to ensure proper installation of the telecommunications cabling system.

1.3 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data: provide one submittal containing the following information:
 - 1. Hand-held testing equipment manufacturer, model, last calibration date/calibration due date and software version.
 - 2. Injector equipment manufacturer, model, and software version.

1.4 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Test Reports.

1.5 REFERENCES

- A. The following Performance Standards shall be followed. Unless otherwise stated, where Performance Standards conflict with manufacturer's recommendations, the more restrictive shall be applied:
 - 1. TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - 2. TIA-526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - 3. TIA-568-C.0 Generic Telecommunications Cabling For Customer Premises
 - 4. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
 - 5. TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards

6. TIA-568-C.3 Optical Fiber Cabling Components Standard
7. TIA-568-C.4 Broadband Coaxial Cabling and Components Standard

1.6 TEST EQUIPMENT

- A. Test Equipment: JDSU Certifier40G, Fluke DSX-5000, Fluke DTX-1800 or TIA & Connectivity Manufacturer approved Level IV (or better) Certifier.
- B. The software version for the testers shall be the latest version available.
- C. The tester must have been calibrated within the last 12 months with calibration date noted on all test results.

1.7 LINK DEFINITION FOR THE PROJECT

- A. A link consists of up to 90 meters (295 feet) of horizontal cabling, a connection at each end, up to 2 meters of test equipment lead from the main unit of the hand-held tester to the local connection, and up to 2 meters of test equipment lead from the remote unit to the remote connection. A total length of up to 94 meters (308 feet).
- B. The connection to the equipment at each end of the link is not included in the link definition.

1.8 CHANNEL DEFINITION FOR THE PROJECT

- A. A channel consists of up to 90 meters (295 feet) of horizontal cabling, a connection at each end, up to 7 meters for the cross-connect and equipment cable, and up to 3 meters for the work area equipment cable. A total length of up to 100 meters (328 feet).
- B. The connection to equipment at each end of the channel is not included in the channel definition.

PART 2 - COPPER CABLING ACCEPTANCE TESTING

2.1 ACCEPTANCE TESTS

- A. The following field acceptance tests shall be performed for twisted - pair cabling:
 1. Wire Map (continuity).
 2. Length.
 3. Attenuation.
 4. NEXT.
 5. ACR-F
 6. Delay and delay skew.
 7. Return loss.
 8. Power sum crosstalk (PSNEXT and PSACR-F).

2.2 TEST EQUIPMENT SET-UP AND TEST PARAMETERS

- A. Autotest: Use the Autotests to perform the required tests. Customize the Autotest as necessary to satisfy testing requirements and parameters.
- B. Cable Type: Select the cable type being tested. Cable Type may vary. Always change the NVP for the type of cable being tested.
- C. Frequency Range: The frequency range for category 6A tests shall be 1 MHz to 500 MHz.
- D. Cable Pairs: Test all cable pairs. Select all pairs for TEST and all pairs for Pass/Fail criteria for Autotest.
- E. Length Units: Cable length test results shall be in feet.
- F. Date Style: The date style shall show month, day, and year. Date shall be the date the test is conducted.
- G. Language: The language shall be English.

2.3 TEST PROCEDURE

- A. Testing shall be performed with the tester at the distribution frame and the remote unit at the Work Area Outlet.
- B. A Channel OR Permanent Link certification test will be performed as outlined in the specific job description.
- C. Test leads and test hardware have limited life-cycles. Inspect and replace the test leads as necessary.
- D. Use only test leads specified by the test equipment manufacturer.
- E. Strictly follow the test equipment manufacturer's instructions for equipment setup, initialization, and calibration.

PART 3 - TESTING DOCUMENTATION

3.1 DOCUMENTATION

- A. The Test Documentation requirements are the minimum requirements. Other details of presentation and recording methods will be discussed with Owner and Design Professional. Gain approval from Owner and Design Professional of the test documentation format and content prior to full-scale testing. Coordinate with Owner and Design Professional to get representative sample of the documentation format and content for review.

- B. Provide Owner with a printed copy of ONLY the summary report of all tests, the electronic file of the test results for each test on CD or USB, and the electronic copy of the summary report on CD or USB. Do not print out each report.

3.2 TEST REPORT

- A. The following header fields on each test report shall contain the appropriate information. These are minimum requirements.
 - 1. Circuit ID
 - 2. Test Result
 - 3. Owner
 - 4. Test Equipment Serial Number
 - 5. Software Version
 - 6. Calibration Date
 - 7. Date
 - 8. Cable Type
 - 9. NVP
 - 10. Building
 - 11. Closet
- B. The information in each user definable header field on each test report shall contain the information as follows.
 - 1. Circuit ID: Indicate the outlet location number and jack number under test
 - 2. Owner: Indicate the owner of the test equipment
 - 3. Date: Indicate the date of the test
 - 4. Cable Type: Indicate the cable type being tested
 - 5. NVP: Indicate the field measured NVP
 - 6. Building: Indicate the building where the cable is being tested
 - 7. Closet: Indicate the closet identifier where the cable is terminated
- C. The minimum test result information on each report shall include the data for the tests identified in the Acceptance Tests paragraph of each applicable testing part.
- D. Contractor shall provide the test data in a complete and consistent format. Printed test results shall be printed from a laser printer.
- E. The contractor shall verify that a report for each jack in the Project is contained in the file list.
- F. Two weeks (14 days) prior to scheduled telecommunications systems start-up date Design Professional shall receive from Contractor complete printed cable performance test results via the submittal process (see 27 0010). Start-up shall not commence unless test results are submitted.

3.3 ELECTRONIC COPY

- A. The electronic copy of the test results shall be on CD or USB.

- B. The electronic copy shall be labeled. The label shall read:

Project Name

Building name (BLDG. No. x)

"Copper/Fiber Test Results"

"CD No." X of X

date (month and year)

- C. The files shall not be altered from the original test equipment output.

END OF SECTION 271200

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SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING AND CONNECTIVITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 270010 – Communications General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies, as well as performing all operations necessary to complete the installation of the Structured Cabling System. This includes the horizontal cabling and connectivity infrastructure required to support voice, data, video, and other communication services. The contractor shall provide and install all materials necessary to form a complete and fully operational system, whether or not specifically detailed in the technical specifications.

1.3 REFERENCES

- A. The Installation requirements are found in the following the American National Standards Institute (ANSI) and Telecommunications Industry Association (TIA) Standards.
 - 1. ANSI/TIA-568-D Generic Telecommunications Cabling for Customer Premises
 - 2. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. ANSI/TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product Data - provide one submittal containing the following information:
 - 1. Manufacturer's catalog cuts showing complete descriptive data for all components required.
 - 2. Manufacturer and Contractor Certifications are required submittals in the Division 27 General Provisions specifications section. The Manufacturer Certification is based on the material information listed below in the Acceptable Manufacturers paragraph.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Drawings.
 - b. Include manufacturer's maintenance information.
 - 2. Startup and test reports.
 - 3. Manufacturer's Warranty: Submit manufacturers standard warranty document.

1.6 WORK BY OTHERS

- A. In general, the following is provided or is of note:
 - 1. Electrical Contractor will provide field conduit paths for use by the horizontal cable and connectivity contractor or other division 27 Contractor.

1.7 FIRESTOPPING

- A. Contractor shall be responsible for firestopping all conduit sleeves (internally only) and cable tray where required to maintain integrity of fire and/or smoke walls. The Contractor shall review architectural drawings to determine which walls have a fire and/or smoke rating. Any rating other than "non-rated" shall constitute a wall that requires fire stopping in all penetrations/openings.
- B. Refer to Section 270010 in Openings, Cutting, and Patching for additional requirements and instructions.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE AND CONNECTIVITY PRODUCTS

- A. Cabling and connectivity products (devices, cover plates, patch panels, insulation displacement connectors, etc.) must be part of a matched solution, provided by manufacturers that have been tested together and provide a fully certified end-to-end system.
- B. Contractor shall provide for all acceptable manufacturer matched solutions. A minimum 20-year product component and performance manufacturer's warranty.
- C. Acceptable Manufacturers:
 - 1. Panduit Mini-Com Cat6a UTP connectivity w/ General GS10000 Cat6a cable.

D. Cable Jacket Rating:

1. Plenum

E. 8P8C (RJ45 type) Modular Jack

1. Shall match the acceptable manufacturer solution chosen in this section.
2. All modular Jacks shall be white in color.

F. Patch Panel

1. 2RU, 48 Port, Modular, angled Patch Panels.
2. Shall match the acceptable manufacturer solution chosen in this section.

G. Additional Cabling and Connectivity Requirements:

1. Furnish and install cable between telecommunications room and field device locations as
2. noted on the drawings.
3. Each field jack shall have a dedicated cable.
4. Provide cable terminations at telecommunications room.
5. Provide cable terminations at all field locations with an 8 pin, 8 conductor (RJ45 type) modular jack and flush wall plate per drawings.
6. Terminate using T568B wiring schematic unless noted otherwise.
7. Provide stainless-steel wall faceplates from the same connectivity manufacturer per location requirements for all field devices.
8. Configure faceplates as required for individual field locations per drawings.
9. Blanks shall be installed in all empty jack locations.
10. Provide terminations onto insulation displacement connectors for high pair count copper cables.
11. Provide surge protection for all exterior-connected copper communications cabling in accordance with Section 27 05 26 – Grounding and Bonding for Communications.

2.2 FIRE ALARM PANEL CONNECTIONS

- A. Two fire alarm panel information drops shall be furnished and installed by the Contractor for each fire alarm head end panel. These drops shall be provided when required, whether they are shown on the project drawings or not.

B. Acceptable Manufacturers:

1. UTP cabling shall match the acceptable manufacturer solution selected in this section 2.01.C.
2. Terminate cabling on standard 8P8C (RJ45 type) modular jack matching the acceptable manufacturer product chosen in this section 2.01.E.
3. Install the 8P8C (RJ45 type) modular jack in a 2-port surface mount housing from the Acceptable Manufacturer selected from this section 2.01. C.

PART 3 - EXECUTION

3.1 PROTECTION OF CABLE AND DEVICES FROM CONTAMINANTS

- A. Contaminants are defined as any material that negatively impacts the validity of the manufacturer's performance warranty. This includes, but is not limited to, paint overspray (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that may come into contact with the cable, cable jacket, or cable termination components.
 - 1. Paint overspray on any cable, cable jacket, termination component, or device will not be accepted.
 - 2. The use of any cleaning agents to remove overspray shall require the cable manufacturer's written consent.
 - 3. Replace any cable, device, component, or assembly affected by a contaminant.
 - a. This shall be done at no additional cost to the project

3.2 INSTALLATION AND LABELING

- A. Install communication systems cables and auxiliary materials as indicated in accordance with manufacturer's written instructions, and recognized industry practices.
 - 1. In general, all interior cables are installed in conduit.
 - 2. D rings are allowed in telecommunications room as needed.
 - 3. Contractor shall use hook and loop type fasteners on all UTP telecommunications cable. Tie wraps may be temporarily used loosely for dressing UTP cables during installation if they are removed before final inspection. Any tie wrap found in place around UTP cable tight enough that a 0.5" wooden dowel cannot be inserted into the bundle at the tie wrap location shall therefore obligate the Contractor to replace those potentially damaged UTP cables at the Design Professionals discretion, whether they pass electronic testing or not.
 - 4. Tie wraps may be used carefully on OSP and armored cabling at light tension levels which do not result in any visible cable jacket deformation.
 - 5. If unarmored fiber is specified without innerduct for any reason, tie wraps are forbidden on that cabling.
 - 6. All tie wraps used in the project shall be trimmed flush at the locking device using a fully flush cutter tool for safety. Any tie wrap found with a sharp point shall be removed by the Contractor and replaced without additional compensation.
- B. Identify all copper, and coaxial cables that terminate in the telecommunication room as to field location.
 - 1. For further cable identification and labeling see section 270553 Identification for Communications Systems.
- C. After completion, all cables shall be thoroughly tested in accordance with the Division 27 Testing and Documentation section.
 - 1. Contractor shall provide all instruments for testing the cables.

2. Contractor shall demonstrate in the presence of Owner's representative that the communications system is complete and operational.
 3. Contractor shall complete and submit the Certificate of System Demonstration.
- D. After completion, comprehensive As-Builts will be created and posted in each Telecom Room within 3 days.
1. Two hard copies shall be created for each Telecom Room detailing the entire structured cabling plant and labeling scheme after installation.
 2. One copy shall be posted in each corresponding Telecom Room, and the other copy shall be submitted to the Design Professional for review according to the submittal process identified in the shop drawing paragraph of Specification Section 270010. This second copy will then be forwarded to Owner.
 3. For further As-Built instructions regarding the documentation of the installed horizontal cabling plant see the communications systems identification record portion of Specification Section 270553.

END OF SECTION 271500

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SECTION 280010 - ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Refer to Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements, which all apply to work under this section.

1.2 DESCRIPTION OF WORK

- A. This section applies to all work under this division. This shall include, but not necessarily be limited to, the following:
 - 1. Furnish, install, and terminate all system equipment and cabling as applicable and per drawings.
 - 2. Furnish and install any cabinets, racks and cable management as required and as indicated.
 - 3. Furnish any other material required to form a complete and operational system.
 - 4. Provide As-Built drawings per Division 0 and/or Division 1 specification.
 - 5. Provide Owner training and testing documentation.
 - 6. All elements of the construction shall be performed by workmen skilled in the particular craft involved, and regularly employed in that particular craft.
 - 7. All work shall be performed in a neat, professional manner in keeping with the highest standards of the craft.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. National Electrical Code
 - 2. Local Electrical Code
 - 3. National Fire Protection Association
 - 4. National Electrical Manufacturers Association
 - 5. Standards of Institute of Electrical and Electronic Engineers
 - 6. Applicable Building Codes
 - 7. Occupational Safety and Health Act
 - 8. Iowa Administrative Codes
 - 9. ANSI TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - 10. ANSI TIA-526-14-C Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - 11. ANSI TIA-568-C.0 Generic Telecommunications Cabling For Customer Premises
 - 12. ANSI TIA-568-C.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements

13. ANSI TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
14. ANSI TIA-568-C.3 Optical Fiber Cabling Components Standard
15. ANSI TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
16. ANSI TIA-569-D Telecommunications Pathways and Spaces
17. ANSI TIA-570-C Residential Telecommunications Infrastructure Standard
18. ANSI TIA-598-D Optical Fiber Cable Color Coding
19. ANSI TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure
20. ANSI TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
21. ANSI TIA-758-B Customer-owned Outside Plant Telecommunications Infrastructure Standard
22. National Fire Protection Agency (NFPA - 70), National Electrical Code (NEC)

- B. All Contractors shall familiarize themselves with all codes and standards applicable to their work. No extra compensation will be allowed for corrections or changes in the work required due to failure to comply with the applicable codes and standards. Where two or more codes or standards are in conflict, that requiring the highest order of professionalism shall take precedence, but such questions shall be referred to Design Professional for final decision.

1.4 REQUIREMENTS & FEES OF REGULATORY AGENCIES

- A. Contractor shall comply with the rules and regulations of the local serving utility companies and shall check with each utility company providing service to this project and determine or verify their requirements regarding incoming services.
- B. Secure all required permits and pay for all inspections required in connection with the telecommunication systems work. Contractor shall post all bonds and obtain all licenses required by the State, City, County, and Federal Agencies.

1.5 DRAWINGS

- A. Drawings for the work are in part diagrammatic, and are intended to convey the scope of the work and to indicate in general the location of equipment.
- B. Contractor shall layout their own work and shall be responsible for determining the exact quantities and locations for equipment.
- C. Contractor shall take own field measurements for verifying locations and dimensions; scaling of the drawings will not be sufficient for laying out the work.
- D. Because of the scale of the drawings, certain basic items for a complete installation are not shown, but where such items are required by code or where they are required for proper installation and operation of the work, such items shall be furnished and installed.

1.6 ACTIVE SERVICES

- A. Contractor shall be responsible for verifying exact locations of all existing services prior to beginning work in that area.
- B. When active services are encountered which require relocation, Contractor shall make request to authorities with jurisdiction for determination of procedures.
- C. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the authorities having jurisdiction.

1.7 SITE INSPECTION

- A. Contractor shall inspect the site prior to submitting bid for work to become familiar with the conditions of the site which will affect the work and shall verify points of connection with utilities and/or existing system wiring.
- B. Extra payment will not be allowed for changes in the work required because of Contractor's failure to make this inspection.

1.8 COORDINATION AND COOPERATION

- A. It shall be the Contractor's responsibility to schedule and coordinate work with the schedule of the General Contractor so as to progress the work expeditiously, and to avoid unnecessary delays.
- B. Contractor shall fully examine the drawings and specifications for other trades and shall coordinate the installation of their work with the work of the other contractors. Contractor shall consult and cooperate with the other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to their equipment, other equipment and the building. The Design Professional reserves the right to determine space priority of the contractors in the event of interference between piping, conduit, ducts and equipment of the various contractors.
- C. Conflicts between the drawings and the specifications, or between the requirements set forth for the various divisions shall be called to the attention of the Design Professional. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that the Contractor is in agreement with the drawings and specifications as issued. If clarification is required after the contract is awarded, such clarification will be made by the Design Professional and the decision will be final.
- D. Special care shall be taken for protection for all equipment. All equipment and material shall be completely protected from weather elements, painting, plaster, etc., until the project is substantially completed. Damage from rust, paint, scratches, etc., shall be repaired as required to restore equipment to original condition.
- E. Protection of all equipment during the painting of the building shall be the responsibility of the Painting Contractor, but this shall not relieve the Contractor of the responsibility for checking to assure that adequate protection is being provided.

- F. Where the final installation or connection of equipment in the building requires the Contractor to work in areas previously finished by the Owner, the Contractor shall be responsible that such areas are protected and are not marred, soiled or otherwise damaged during the course of such work. Contractor shall be responsible for patching and refinishing of such areas which may be damaged in this respect.
- G. Where two or more specified items/systems in the specifications and/or the drawings are in conflict, that requiring the highest order of professionalism and the most financially expensive products shall take precedence. Such questions shall be referred to the Design Professional for final decision.

1.9 MATERIALS AND EQUIPMENT

- A. All materials and equipment shall be the standard product of a reputable manufacturer regularly engaged in the manufacture of the specified item unless authorized in writing by Design Professional. Where more than one unit is required of the same items, they shall be furnished by the same manufacturer except where specified otherwise.
- B. All material and equipment shall be installed in strict accordance with the manufacturer's recommendations.
- C. The equipment specifications cannot deal individually with any minute items such as parts, controls, devices, etc., which may be required to produce the equipment performance and function as specified, or as required to meet the equipment guarantees. Such items when required shall be furnished as part of the equipment, whether or not specifically called for.

1.10 SUBMITTALS

- A. Contractor shall furnish, to the Design Professional, complete sets of shop drawings and other submittal data. Contractor shall review and sign shop drawings before submittal. Refer to Division 01 specifications for additional requirements.
- B. Shop drawings shall be bound into sets and cover related items for a complete system as much as practical and shall be identified with symbols or "plan marks" used on drawings. Incomplete, piecemeal or unbound submittals will be rejected.
- C. The Design Professional will review shop drawings solely to assist contractors in correctly interpreting the plans and specifications.
- D. Contract requirements cannot be changed by shop drawings which differ from contract drawings and specifications.
- E. Submittal requirements are indicated in each corresponding technical specification section in the Project Manual.
- F. After award of contract, the contractor shall provide a completed submittal schedule including dates that the submittals will be to the Design Professional for review.

1.11 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be submitted to the Design Professional in duplicate upon completion of the job. Refer to Division 01 specifications for additional information.
- B. Submit manuals in duplicate upon completion of the job. Manuals shall be bound in a three-ring hard backed binder. Front cover and spine of each binder shall have the following lettering done:

OPERATION
AND
MAINTENANCE
MANUAL
FOR
COMMUNICATION SYSTEMS

(PROJECT NAME)
(LOCATION)
(DATE)

SUBMITTED BY
(NAME, ADDRESS AND PHONE NUMBER OF CONTRACTOR)

- C. Provide a master index at the beginning of manual showing items included. Each section shall contain the following information for equipment furnished under this contract:
 - 1. Equipment and system warranties and guarantees.
 - 2. Installation instructions.
 - 3. Operating instructions.
 - 4. Maintenance instructions.
 - 5. Spare parts identification and ordering list.
 - 6. Local service organization, address, contact and phone number.
 - 7. Shop drawings with reviewed stamp of Design Professional and Contractor shall be included, if applicable, along with the items listed above.

1.12 TESTS AND DEMONSTRATIONS

- A. All systems shall be tested by the Contractor and placed in proper working order prior to demonstrating systems to Owner.

1.13 TRAINING AND DEMONSTRATIONS

- A. Prior to acceptance of the telecommunications installation, the Contractor shall provide to the Owner, or their designated representatives, all comprehensive training on essential features and functions of all systems installed, and shall instruct the Owner in the proper operation and maintenance of such systems.
 - 1. Provide adequate notice to the Owner as to when instruction will be conducted so appropriate personnel can be present.
 - 2. Prepare the instruction format for a minimum of four Owner Representatives.

B. Equipment training:

1. Manufacturer's representatives shall provide instruction on each major piece of equipment. The Contractor shall provide instruction on all other equipment.
2. Training sessions shall use the printed installation, operation and maintenance instruction materials included in the O&M manuals and emphasize preventative maintenance and safe operating procedures.
3. Training shall be performed by qualified factory trained technicians.
4. The Contractor shall attend all sessions performed by the manufacturer's representative and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
5. Equipment training shall occur as soon as possible after start up of the equipment and shall include hands-on operation. Training shall be provided for equipment listed in the table below.

C. System training:

1. Training sessions shall include hands-on demonstrations of system wide start-up, operation in all possible modes, shut-down and emergency procedures.

D. The Contractor shall submit a certificate, signed by the Owner stating the date, time and persons instructed and that the instruction has been completed to the Owner's satisfaction. An example of a certificate form is as follows:

CERTIFICATE OF SYSTEM DEMONSTRATION

This document is to certify that the contractor has demonstrated the hereafter listed systems to the Owner's representatives in accordance with the Contract documents and that the instruction has been completed to the Owner's satisfaction.

- A. Project:
- B. System(s):
- C. Contractor's representatives giving instruction and demonstration:

Contractor: _____

NAMES	DATE	HOURS

- D. Owner's representatives receiving instruction:

Owner: _____

NAMES	DATE	HOURS

- E. Acknowledgement of demonstration:

Contractor's Representative:

Signature

Date

Owner's Representative:

Signature

Date

1.14 SUBSTITUTIONS

- A. To obtain approval to use unspecified equipment, Bidding Contractors (not equipment supplier, manufacturers, etc.) shall submit written requests to the Design Professional at least 10 days prior to bid due date. Requests shall clearly describe the equipment for which approval is being requested. Include all data necessary to demonstrate that equipment's capacities, features and performance are equivalent to include a cost comparison between specified equipment and equipment for which approval is being requested. If the equipment is acceptable, the Design Professional will approve it in an addendum. The Design Professional will, under no circumstances, be required to prove that an item proposed for substitution is or is not of equal quality to the specified item.
- B. Where substitutions are approved, Contractor assumes all responsibility for physical dimensions and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of the substitution.

1.15 APPROVED CONTRACTORS

- A. The Contractor shall be a manufacturer certified installer and service provider for the product submitted and installed. A copy of the Contractor's manufacturer certification must be submitted under this specification section for the Access Control Contractor and the Video Surveillance Contractor if applicable to the project. The Contractor is responsible for professional and installation practices in accordance with the manufacturer requirements and must be authorized to provide a Manufacturer's Product Warranty with their installation.
- B. The Contractor pulling the cabling (if different from the prime system Contractor) shall meet the BICSI or IBEW/NECA requirements found in the Division 27 General Provisions.

1.16 ACCEPTABLE MANUFACTURERS

- A. In most cases, equipment specifications are based on a specific manufacturer's type, style, dimensional data, catalog number, etc. Listed with the base specification, either in the manual or on the plans are acceptable manufacturers approved to bid products of equal quality. These manufacturers are encouraged to submit to the Design Professional at least 8 days prior to the bid due date drawings and catalog numbers of products to be bid as equals.
- B. Manufacturers who do not submit prior to bidding run the risk of having the product rejected at time of shop drawing submittal. Extra costs associated with replacing the rejected product shall be the responsibility of the Contractor and/or the manufacturer.
- C. If the Contractor chooses to use a manufacturer listed as an equal, it shall be their responsibility to assure that the manufacturer has complied with the requirements in 'A' above. Contractor shall assume all responsibility for physical dimensions, operating characteristics, and all other resulting changes. This responsibility extends to cover all extra work necessitated by other trades as a result of using the alternate manufacturer.

- D. Where a model or catalog number is provided, it may not be inclusive of all product requirements. Refer to additional requirements provided on the plans or in the specifications as required. Similarly, there may be additional requirements included in the model or catalog number that are not specifically stated. These requirements shall also be met.

1.17 QUALITY ASSURANCE

- A. The Contractor shall be a company specializing in telecommunication cable and/or accessories with a minimum of five years documented experience in installation of cable and/or accessories similar to those specified below.

1.18 WARRANTY

- A. Refer to Divisions 00 and 01 for information on warranties and correction of work within the warranty period.
 - 1. If a warranty or warranty period are not defined in Division 00 or 01, then the start of all warranty periods shall be the date of Substantial Completion and the length of the warranty shall be for one year.
 - a. If construction is phased with distinct and separate Substantial Completion dates for portions of the building and/or systems, separate warranties shall be provided for each of these phased areas and/or systems.
 - b. All Division 28 systems, including all sub-systems, shall be guaranteed against defect in materials and installation for the duration of the warranty period. Any malfunctions or defects which occur within the warranty period shall be promptly corrected without cost to the Owner. This guarantee shall not limit or void any manufacturer's express or implied warranty.
- B. Refer to other Division 28 sections for systems, equipment, or material requiring extended warranties.
- C. The date of systems/equipment startup or equipment/material shipment to the site shall not be considered the notable date with relation to the warranty of that item. All systems, equipment, material, etc., shall have the same start date with respect to the warranty period.
- D. Systems, equipment or material put into use to facilitate construction activities (e.g. testing and balancing, commissioning, temporary conditioning, etc.) prior to the start of the warranty period shall not impact the length of the warranty in any way.

1.19 CHANGES IN THE WORK

- A. A Contract Change Order is a written order to the Contractor signed by the Owner and Contractor, issued after the execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Contract Change Order.

- B. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, with the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Contract Change Order and shall be performed under the applicable conditions of the Contract Documents.
- C. The cost or credit to the Owner resulting from a change in the Work shall be determined by mutual acceptance of a lump sum properly itemized and supported by sufficient substantial data to permit evaluation. Change Orders shall be submitted with each item listed individually with a material cost and labor unit extension. Overhead and profit, as mutually agreed upon between Owner and Contractor shall be added to material and labor cost figures.
- D. It shall be the responsibility of the Contractor before proceeding with any change to satisfy themselves that the change has been properly authorized on behalf of the Owner.

1.20 COMPLETION

- A. Systems, at time of completion, shall be complete, efficiently operating, non-hazardous and ready for normal use by the Owner.
- B. When all the work is complete the Contractor shall thoroughly clean all material and equipment installed as a part of this contract and leave all equipment and material in new condition.
- C. The Contractor shall clean up and remove from the site all debris, excess material and equipment left during the progress of this contract at job completion.

END OF SECTION 280010

SECTION 283100 - FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 - Procurement and Contracting Requirements, Division 01 - General Requirements and Section 280010 – Electronic Safety and Security General Provisions are applicable to work required of this section.

1.2 QUALITY ASSURANCE

- A. The system installation and wiring shall comply with applicable provisions of the current issue of NFPA 72, International Building Code, International Mechanical Code, Iowa State Building Code, Iowa Administrative Code, Americans with Disabilities Act, and codes and regulations of local authorities having jurisdiction.
- B. NEC Compliance: Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories.
- C. UL Compliance and Labeling: Provide fire alarm and detection system components which are UL listed and labeled.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. National Fire Protection Association; NFPA 70, NFPA 72, NFPA 80, NFPA 20, NFPA 13
 - 2. National Electrical Manufacturers Association
 - 3. Standards of Institute of Electrical and Electronic Engineers
 - 4. International Building Code
 - 5. Occupational Safety and Health Act
 - 6. Iowa Administrative Code
 - 7. NECA Standards
 - 8. Americans With Disabilities Act (ADA)
 - 9. ASME A17.1 State Elevator Code
 - 10. Regulations of local authorities having jurisdiction.

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.

B. Product data: provide one submittal containing the following information:

1. Submittal data for the fire alarm equipment shall consist of shop drawings outlined in NFPA 72 shop drawing requirements and include but not limited to: block diagrams of layout and operation of the system, full size drawings with device locations and addresses, battery power calculations, audible and visual device power supply calculations, voltage drop calculations, list of device identification and addresses that will be displayed on the control panel(s), quantities of equipment, catalog cuts showing technical data necessary to evaluate the equipment and other descriptive data necessary to describe fully the equipment proposed.
2. In no instance shall the contract drawings be reproduced for shop drawing submittals.
3. Contractor is responsible for any fees associated with the review and approval of the fire alarm drawings and product data by the Authority Having Jurisdiction (AHJ). Contractor is also responsible for completion of the required fire alarm system submittal form and submittal of the final fire alarm shop drawings to the AHJ.

1.5 CLOSEOUT DOCUMENTS

A. Refer to Division 01 Closeout requirements.

B. Provide closeout items containing the following:

1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings.
 - b. Include manufacturer's maintenance information.
 - c. Operation and Maintenance Data: Include detailed information on device programming and setup.
2. Startup and test reports: Submit reports immediately upon completion of tests.
3. Manufacturer's Warranty: Submit manufacturers standard warranty document.
4. System training.
5. Spare Parts.
6. As-builts.

1.6 RECORD DRAWING REQUIREMENTS

A. Record drawings shall be provided prior to the time of scheduling of the final inspection. They shall include the location of the overcurrent protection that feeds any fire alarm related equipment and shall be clearly marked on the drawings. Include changes made during system testing and acceptance.

1. The following should be included:
 - a. Alarm initiation devices with addresses.
 - b. Alarm signal devices with module locations/addresses and circuit numbers.
 - c. Door holders and smoke dampers with module location and addressed.
 - d. Air handling units with module and relay locations and addresses.
 - e. Junction pull boxes.

- f. Layout of conduit with circuit identification.
- g. 120 VAC power sources for control panels, door holders, and fire/smoke dampers.
- h. Location of all end of line resistors.
- i. Calculations for voltage drop on circuits, battery, and audio amplifier sizing.

1.7 SYSTEM OPERATION

- A. Control of System: By the existing Fire Alarm Control Panel.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the Fire Alarm Control Panel after initiating devices are restored to normal. Equipment that has been by-passed in software shall not change state of condition during a "reset".
 - 1. Fire Alarm Control Panel shall be reprogrammed so that it can be reset only when a security level access level of 3 or greater is used.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the Fire Alarm Control Panel initiates a trouble signal at the Fire Alarm Control Panel and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:
 - 1. Notification-appliance operation.
 - 2. Initiation of alarm system except for individual sleeping rooms.
 - 3. Identification at the Fire Alarm Control Panel and the remote annunciator of the device originating the alarm.
 - 4. Transmission of an alarm signal to the remote alarm receiving station.

5. Release of fire and smoke doors held open.
 6. Release of fire and smoke doors hold open if a detector adjacent to the door is in alarm.
 7. Recall of elevators if the alarm is initiated by a detector located in an associated machine room, hoistway, or elevator lobby.
 8. Shutdown of fans and other air-handling equipment serving the fire zone where alarm was initiated.
 9. Initiation of smoke control sequence(s).
 10. Closing of smoke dampers in air ducts of system serving the fire zone where alarm was initiated.
 11. Recording of the event in the system memory.
 12. Initiation of automatic mass notification messages from main panel, annunciator panel and telephone interface.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the Fire Alarm Control Panel and the remote annunciator.
1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 2. Subsequent alarm signals from other devices or fire zones reactivate notification appliances until silencing switch is operated again.
 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Operating a heat detector in the elevator shaft or elevator machine room shuts down elevator power by operating a shunt trip device in the circuit feeding the elevator.
1. A field-mounted relay actuated by the Fire Alarm Control Panel closes the shunt trip circuit and operates building notification appliances and annunciator.
- L. Operating a smoke detector in the elevator shaft, elevator machine room or elevator lobby initiates Phase I Emergency Recall Operation automatically recalling the elevator to the main level of egress or the alternate recall level if the main level elevator lobby smoke detector is in alarm.
- M. Operating the fireman's control key for the elevator shall initiate Phase II Operation and bypass all automatic controls.
- N. Smoke detection for zones or detectors with alarm verification initiates the following:
1. Audible and visible indication of an "alarm verification" signal at the Fire Alarm Control Panel.
 2. Activation of a listed and approved "alarm verification" sequence Fire Alarm Control Panel " and the detector
 3. General alarm if the alarm is verified.
 4. Cancellation of the Fire Alarm Control Panel indication and system reset if the alarm is not verified.
- O. Sprinkler flow switch operation initiates the following:
1. General alarm

2. Dedicated system horn/strobe device located at the fire department connection. This device shall only operate on sprinkler flow.
- P. Sprinkler valve-tamper switch operation initiates the following:
1. A supervisory, audible, and visible "valve-tamper" signal indication at Fire Alarm Control Panel and the annunciator.
 2. Transmission of supervisory signal to remote alarm receiving station.
- Q. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system initiates the following:
1. A supervisory, audible, and visible "sprinkler trouble" signal indication at the Fire Alarm Control Panel and the annunciator.
 2. Transmission of trouble signal to remote central station.
- R. Remote Detector Sensitivity Adjustment: Manipulation of controls at the Fire Alarm Control Panel causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- S. Removal of an alarm-initiating device or a notification appliance initiates the following:
1. A "trouble" signal indication at the Fire Alarm Control Panel and the annunciator for the device or zone involved.
 2. Transmission of trouble signal to remote alarm receiving station.
- T. Fire Alarm Control Panel Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.
1. The upper line of the display shall indicate the zone in alarm according to the zone schedule on drawings.
 2. The lower line of the display shall indicate the address of the device in alarm.
- U. LED Lights:
1. Only fire alarm zone lights and "device type" lights shall annunciate with a red LED. Device type, address and exact location shall annunciate on the digital readout.
 2. Any by-pass, disable, or trouble condition shall annunciate with an amber LED, a trouble sounder and annunciate on the digital readout. A "trouble pending" control module shall be included.

1.8 ACTIVE SYSTEMS

- A. Existing Fire Alarm Equipment: Maintain operation of existing to remain fire alarm system. System downtime shall be kept to a minimum. Provide fire watch personnel as necessary for building occupant notification during downtime. Fire alarm system shall be left in full operational condition at the end of each workday.
- B. Equipment Removal:
 - 1. Package operational fire alarm and detection equipment that has been removed and deliver to Owner.
 - 2. Remove from site and legally dispose of existing material not designated for other disposition.

1.9 WARRANTY

- A. General Warranty: The 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. Special Warranty: A written warranty, signed by Contractor and manufacturer, agreeing to replace components that do not meet requirements or that fall within the specified warranty period.
 - 1. Warranty Period: One year from date of Final Acceptance. Full warranty applies throughout the warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide fire alarm and detection systems of one of the following:
 - 1. Honeywell/Notifier: Midwest Alarm Services (existing fire alarm system)
 - 2. The equipment supplier shall provide the services of a factory trained representative. They shall supervise the system installation and final connections to the equipment and provide testing to assure that the system is in proper operating condition.

2.2 FIRE ALARM AND DETECTION SYSTEMS

- A. General: Modify the existing fire alarm and detection system products of types, sizes, and capacities indicated, which comply with manufacturer's standard design, materials, components; construct in accordance with published product information, and as required for complete installation. Modify the fire alarm and detection systems for applications indicated, with the sequence of operations, components and function features indicated.
- B. Materials and Equipment:
 - 1. Wiring System Materials: Provide basic wiring materials which comply with 260010 – Electrical General Provisions, 260553 – Raceway and Boxes for Electrical Systems, and 260519 - Low-Voltage Electrical Power Conductors and Cables; types to be selected by Installer.
 - a. Junction and Pull Boxes:
 - 1) Junction and pull boxes shall be clearly marked. This shall be done by painting the covers red, and properly labeling them.
 - 2) All junction and pull boxes located at or above 8'0" from the floor shall be a minimum size of 4 11/16".
 - 3) No box extensions shall be permitted on new work.
 - 4) All junction boxes shall be readily accessible.
 - 5) No splicing in device mounting boxes.
- C. Manufacturer's Equipment: Provide manufacturer's standard construction equipment for material noted below:
 - 1. Central Fire Alarm Control Panel.
 - a. Existing FireWarden-100-2
 - 1) All devices to be served from one (1) panel.
 - 2. Smoke Detectors
 - a. General: Include the following features:
 - 1) Operating Voltage: 24-V dc, nominal.
 - 2) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 3) Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
 - 4) Sensitivity: Can be tested and adjusted in-place after installation.
 - 5) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the Fire Alarm Control Panel.
 - 6) Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the Fire Alarm Control Panel for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the Fire Alarm Control Panel.
 - b. Photoelectric Smoke Detectors: Include the following features:
 - 1) Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 2) Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

- 3) Magnetically actuated test switch.
 - 4) Integral Thermal Detector: Fixed-temperature type with 135 deg F setting.
 - c. Duct Smoke Detector: Photoelectric type.
 - 1) Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
 - 2) Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
 - 3) Remote Test Switch: Mount near mechanical room door or suitable maintenance type space on stainless steel cover plate. Include floor plan with protective cover to indicate location of corresponding duct smoke detector.
3. Other Detectors
 - a. Heat Detector, Combination Type: Actuated by either a fixed temperature or rate of rise of temperature.
 - 1) Analog temperature measuring device with setpoint (rating) set by Fire Alarm Control Panel.
 - 2) Mounting: Plug-in base, interchangeable with smoke detector bases, where available.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the Fire Alarm Control Panel.
4. Notification Appliances
 - a. Description: Equip for mounting as indicated and have screw terminals for system connections.
 - 1) Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 - b. Visible Alarm Devices: Xenon or LED strobe lights listed under UL 1971 with clear polycarbonate lens.. The word "FIRE" is printed on the device.
 - 1) Rated Light Output: Field selectable 15 through 110 candela minimum per UL 1971 for ADA use unless otherwise indicated on drawing or required to meet NFPA 72 criteria.
 - 2) Strobe Leads: Factory connected to screw terminals.
 - 3) Synchronized operation.
 - 4) Mounting:
 - a) Ceiling: Flush with white baffle.
 - b) Wall: Surface with red or white housing.
 - c) Include skirt for surface mounted devices which do not conceal a standard 4-inch junction box.
 - c. Alarm Horns:
 - 1) Minimum sound pressure 87dB at 10'
 - 2) Separate in/out wiring for signal circuit
 - 3) Mounting:
 - a) Ceiling: Flush with white baffle.
 - b) Wall: Surface with red housing.
 - c) Include skirt for surface mounted devices which do not conceal a standard 4-inch junction box.

5. Magnetic Door Holders
 - a. Description: Units equipped for wall or floor mounting as indicated and are complete with matching door plate.
 - 1) Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
 - 2) Wall-Mounted Units: Surface mounted, unless otherwise indicated.
 - 3) Contact Plate: Adjustable.
 - 4) Armature Plate: Door mounted, adjustable 95 deg. horizontal, 5 deg. vertical.
 - 5) Rating: 24-Vdc.
 - b. Material and Finish: Match door hardware.
 - c. Existing Units: Where existing units are shown for reconnection, provide necessary relays to operate at 24V dc.
 - d. Mount units high on door.
6. Remote Annunciator
 - a. Existing.
7. Battery Power Supply & Batteries
 - a. Modify as required for additional fire alarm device loads.
8. Addressable Interface Devices
 - a. Monitor Module: Microelectronic module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts; allows individual monitoring of non-addressable points.
 - b. Control Module: Microelectronic module listed for use in providing a multiplex system address to relays for system control functions.
 - 1) Relay: 24 VDC coil with red LED when in the "alarm" state; contacts rated 10A, 115 VAC, minimum; suitable for control function required.
9. Digital Alarm Communicator Transmitter
 - a. Existing

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor/Installer shall meet with Owner prior to performing any work on existing/new system(s). Meeting shall determine existing building system functions and approach Contractor/Installer will take to remove the existing system and determine Contractor's/Installer's plan to install new system which includes raceway runs, typical wiring practices, and device and equipment installation, also to provide Contractor/Installer with Owner's expectations.
- B. The locations and spacing of alarm initiating devices and strobes indicated on the drawings are approximate. The equipment supplier shall verify device requirements and spacing and shall add devices as required to satisfy governing authorities. It shall be the responsibility of the equipment supplier or their representative to determine the type of detector required by local authorities for each type of installation.

- C. Install the fire alarm system in accordance with approved manufacturer's wiring diagrams. Furnish all conduit, wiring, outlet boxes, junction boxes, cabinets, and similar devices necessary for a complete installation. Boxes shall be installed in accessible spaces without requiring the removal of light fixtures or any other equipment.
- D. Coordinate system programming with the authority having jurisdiction.
- E. Provide 120 volt power to remote signal circuit power supplies.
- F. Provide fire alarm system power to remote annunciator panels.
- G. Circuit breakers shall be identified and locked in accordance with NFPA 72. Provide Space Age Electronics model ELOCK-FA circuit lockout kit. Apply labels furnished with kit.
- H. Provide switch and fuse stat's (type SOU) installed within the Fire Alarm Control Panel disconnect 120 VAC power and separately all battery power.
- I. Coordinate the installation of equipment and devices that pertain to the work of other trades with the appropriate contractors.
 - 1. Provide connections to 120V smoke dampers provided by the mechanical contractor. Install 120V indicator lights provided with the dampers and wire to position switches.
 - a. Provide dedicated 120 volt circuits for smoke dampers.
 - 2. Provide shut-down relays to initiate HVAC shut down. Locations indicated on the fire alarm drawings are diagrammatic. Coordinate relay installation and HVAC unit shut-down with temperature controls contractor.

3.2 DEVICE INSTALLATION

- A. Provide devices as indicated on drawings and as required to perform specified functions.
- B. Initiating Devices:
 - 1. Smoke Detectors:
 - a. Cover all smoke detection devices immediately after installation to maintain cleanliness.
 - b. Install within five feet of each door held open by the fire alarm system.
 - c. Where adjacent to an air shaft, supply diffuser or return grille, install smoke detector 36 inches minimum from the edge of the diffuser or grille.
 - d. Provide a smoke detector within 10 feet of each remote power supply panel.
 - 2. Duct Detectors:
 - a. Provide duct type smoke detectors in the return ductwork as indicated.
 - b. Locate duct smoke detector within 5' of fire dampers where a detector is indicated to be installed in a duct with a smoke.

- c. Provide a remote alarm LED indicator for each duct smoke detector which is not readily visible or which is located above a ceiling or on a roof. Mount in an easily accessible and readily visible location. Label with the name of the unit served by the detector. Indicate whether the detector is installed in the supply or return ductwork.
 - d. Provide a labeled test switch with LED indicator for each duct smoke detector. Install switch at a height between 48 inches and 72 inches above finished floor.
 - 3. Provide heat detectors in areas where smoke detectors would be subject to false alarm.
 - 4. Program address for each device as directed by Owner or stated elsewhere in specification.
 - 5. Program device output text by address and geographic location.
 - 6. Provide an addressable interface module for each non-addressable device.
 - 7. Provide an addressable interface module for each non-addressable initiating device.
- C. Signaling Devices:
- 1. Where plans indicate a signaling device installed adjacent to a manual station, install the signaling device on the wall directly above the manual station.
 - 2. Provide a minimum of two weatherproof audible signaling devices of the same type as other signaling devices provided with the system. The audible signaling devices will be located by the fire department connection to each building. Owner will determine the exact locations. Mount the devices on the exterior of the building. Provide a separate circuit for exterior audible signaling devices.
 - 3. Signaling devices shall be completely deactivated by pressing "signal silence".
 - 4. Audibles shall be placed so that they can be heard a minimum of 15 decibels above the ambient decibel level in all locations (refer to NFPA 72G and ISBC 17.705(12)).
- D. Control Devices:
- 1. All devices controlled by the Fire Alarm Control Panel (i.e. dampers, doors, elevators, etc.) shall be operated by the use of "control modules" and not by relay type device on detector bases. No auxiliary equipment shall be directly connected to LMX control modules. Control modules shall activate a 24VDC relay with LED when in the "alarm".
 - 2. Elevators: Verify recall requirements with local codes, authorities, and installers prior to system programming. Provide control modules and relays as required.
 - 3. Provide a control module and relay for each door or group of doors to be held open.
 - 4. Provide control modules and relays as required to implement the required control sequences.
 - 5. Provide control modules and relays for remote indication of alarm and trouble conditions.
 - 6. Provide monitor module(s) where conventional non-addressable heat detectors and similar devices are installed.

E. Door Holders:

1. Mount at the top of each door to be held open unless otherwise indicated.
2. Mount the magnet on the wall and the contact plate on the door. Provide extensions as necessary to assure proper mating between the magnet and contact plate. Magnet is to maintain hold of door under normal conditions.
3. Adjust so the door is held parallel to the wall on which the magnet is mounted.
4. Electromagnetic door holders which are indicated to be integral with a door closer shall be furnished by the Design Professional. Provide wiring so the door holders are normally energized from the fire alarm power supply.

3.3 RACEWAYS AND BOXES

- A. Fire Alarm System wiring shall be in a conduit system separate from other wiring systems.
- B. Branch Circuit wiring for the fire alarm system shall be in conduit system separate from other building wiring.
- C. Minimum $\frac{3}{4}$ " steel raceway. Conduit fill shall not exceed 40%.
- D. The raceway system shall be in compliance with Section 260533 - Raceway and Boxes for Electrical Systems. Raceway system shall be factory color red in accordance with 260553 – Identification for electrical Systems.
- E. Where 2-hour circuit integrity cable is required, raceway shall be in strict compliance with the UL Listed FHIT system.
- F. Contractor shall size conduit and boxes by circular mil size of cable in conduit or box.
- G. Surface access to existing alarm initiating circuits in public areas shall be via UL listed surface metal raceways (minimum equivalent to $\frac{3}{4}$ " conduit) and box extensions.
- H. Existing conduit and surface metal raceway that are not $\frac{3}{4}$ " size may be reused if found to have adequate space for existing and new conductors and field identified in accordance with 260533.

3.4 WIRING INSTALLATION

- A. Wiring Method: Use Class B wiring for communication between fire alarm panel equipment and Class B for field mounted devices.

- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors. Do not install spare conductors in conduits or junction boxes.
- C. Cable Taps: All cables in the fire alarm control panel, junction boxes, and pull boxes shall be clearly marked in English (i.e. SLC 1, 3rd Floor Speakers, etc.). Label all junction box covers to indicate circuits and/or devices enclosed. Label inside cover of all junction boxes in finished areas. Label outside cover of all junction boxes in unfinished/concealed areas.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red and provide circuit labels on inside of cover.
- E. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the Fire Alarm Control Panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.
- F. Install end-of-line resistors at the farthest device from panel or module in a separate junction box clearly marked "End-of-Line Resistor."
- G. Conductors (minimum size and color) and raceways shall be provided as listed below, unless otherwise recommended by the system manufacturer or required by the authority having jurisdiction:
- | | | | | |
|----|----------------------------|----------------|------------|-----------|
| 1. | 120VAC | 12AWG | | |
| 2. | Initiating circuits | #18 tw/sh pair | White (+) | Black (-) |
| 3. | Audible signaling circuits | | | |
| | a. Horns/bells | #14AWG | Red (+) | Black (-) |
| | b. Speakers | #14 tw/sh pair | Red (+) | Black (-) |
| 4. | Module power | #14AWG | Violet (+) | Blue (-) |
| 5. | Resettable module power | #14AWG | Yellow (+) | Gray(-) |
| 6. | Visual signaling circuits | #14AWG | Red (+) | Black (-) |
| 7. | Door holder/smoke dampers | #14AWG | Brown (+) | White (-) |
| 8. | Control circuits | #14 AWG | | |
- H. Conduit fill and box fill never to exceed 50%.
- I. No spare conductors shall be installed in conduits or junction boxes.
- J. 3M #130C rubber tape (or approved equal) shall be used to insulate grounding shields.
- K. If surface Wiremold is specified, it shall be no smaller than 700 size.

- L. All junction and pull boxes located at or above 8'-0" from the floor shall be a minimum size of 4-11/16" square by 2-1/8" deep.
- M. No box extensions shall be permitted on new work.
- N. All fire alarm devices, junction and pull boxes shall be installed so they are accessible without removing light fixtures, equipment, conduits, junction boxes or other items.
- O. No splicing will be allowed in device mounting boxes.
- P. "End of Line Resistors" shall be located at the device that is farthest away from the panel or module.
- Q. All devices being controlled by the fire alarm control panel (i.e. dampers, doors, etc.) shall be operated by the use of control modules and not by relay type devices in detector bases. No auxiliary equipment shall be directly connected to an addressable control module. Each control module shall activate a 24 vdc relay with LED when in the "alarm" state.
- R. Back boxes shall be provided by equipment supplier for any surface-mounted pull stations or signaling devices.
- S. T-taps may be used for signaling line circuits if manufacturer's recommendations are followed.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26, Section Identification for Electrical Systems.
- B. Install instructions frame in a location visible from the Fire Alarm Control Panel.
- C. Circuit breakers shall be identified and locked in accordance with NFPA 72. Provide Space Age Electronics model ELOCK-FA circuit lockout kit. Apply labels furnished with kit. Affix the name and telephone number of the local service organization to the inside of the door of the Fire Alarm Control Panel and each remote cabinet.
- D. Label each control module to indicate the equipment controlled.
- E. Maintain wiring color codes throughout the system.
- F. All labels shall be on the inside of the cover.

3.6 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

- B. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.7 ACCEPTANCE TESTING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Electrical Contractor shall be responsible for performing a "Pre-Test" of the Fire Alarm System and preparing/ completing "Test Log".
 - 1. All equipment shall be installed prior to completing "Pre-Test".
 - 2. Scope of the Pre-Test is to:
 - a. "Align, adjust, and balance the system."
 - b. Confirm compliance with the drawings and specifications.
 - c. Install, test and check for operation of 100% of all fire alarm equipment and items being controlled by the fire alarm system.
 - 3. Manufacturer's representative is to be involved in the pre-test.
 - 4. Perform a thorough cleaning of the fire alarm system so each detector's chamber value reads less than 50%.
 - 5. At completion of the pre-test, the fire alarm system is to be complete and ready for owner acceptance.
 - 6. Complete a "Test Log", a written record of inspections, tests, and detailed test results.
- C. In preparation for the final test, Contractor shall:
 - 1. Submit a "Test Log" and test forms from NFPA 72 and include a print out proving detector chamber values of less than 50% for all detectors.
 - 2. Provide a letter certifying pre-test compliance and a list of witnesses.
 - 3. Provide an up to date and complete printout of software at the time of final inspection and after any and all corrections or changes.
 - 4. Coordinate with Owner to record automatic messages for fire alarm and mass notification conditions.
- D. Contractor shall perform a Final "Minimum System Test" per NFPA 72.
 - 1. Contractor shall test all equipment per minimum system testing requirements and maintain a "Test Log".
 - 2. Contractor to have sufficient personnel to conduct the test efficiently.
 - 3. Upon completion of the Final Test Contractor will submit the Test Log.
 - 4. Owner's representative has the authority to void the Final Test if it is proven during the Final Test that the Fire Alarm system installation is not complete.
 - a. Voiding the Final Test will require Contractor to schedule another Final Test.

5. Upon approval of Final Test, successful owner training and submittal of completed “As-Built” drawings and O&M manuals, Owner will provide Contractor with acceptance of new Fire Alarm System.
 - a. Owner acceptance does not constitute “Project Closeout” or completion of “Final Punch List”
 - b. Owner acceptance only relieves Contractor of testing requirements, it does not relieve Contractor of other contract requirements.
 - c. Final Testing does not constitute Owner training.
 - d. Owner acceptance provides approval to activate the new Fire Alarm System as the primary system.
 6. Contractor shall perform final test in the presence of manufacturer's representative, Owner's representatives, and necessary local code authorities.
- E. Minimum System Tests' test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
1. Verify the absence of unwanted voltages between circuit conductors and ground.
 2. Test all conductors for short circuits using an insulation-testing device.
 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohm meter. Record the circuit resistance of each circuit on record drawings.
 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
 5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
 9. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
 10. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of test

- F. The manufacturer's authorized representative shall perform a 100% quality inspection of the final installation and in the presence of Contractor, Owner's Representative and local code and fire authorities, shall perform a complete finished test of all aspects of the system. A system certification verifying the proper system operation shall be required prior to acceptance.
- G. Audible sound level measurements shall be conducted throughout the entire building, and all spaces with the evacuation system off and sounding.

3.8 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer. Provide detector cleaning report proving a maximum chamber value of 50% for all detectors.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours training.
 - 2. Provide a minimum of 8 hours of software program training by a factory trained representative.
 - 3. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
 - 4. Schedule training with Owner, with at least seven days advance notice.

3.10 MAINTENANCE

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.
- B. Provide a maintenance contract from the local service organization beginning on the date of Substantial Completion and remaining in force throughout the warranty period. Include required NFPA testing at times scheduled by Owner.
- C. Provide Owner with a proposal from the local service organization for a one-year maintenance contract beginning at the end of the warranty period.

3.11 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 2 hours in duration. Training date shall be coordinated with the facility owner.

END OF SECTION 283100

SECTION 285000 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 280010 – Electronic Safety and Security General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this access control in compliance with the specifications and drawings. Contractor will provide and install all of the required material to form a complete system.

1.3 CODES AND STANDARDS

- A. All work shall be done in accordance with the applicable portion of the following codes and standards:
 - 1. National Electrical Code
 - 2. Local Electrical Code
 - 3. National Fire Protection Association
 - 4. National Electrical Manufacturers Association
 - 5. Standards of Institute of Electrical and Electronic Engineers
 - 6. Applicable Building Codes
 - 7. Occupational Safety and Health Act
 - 8. Iowa Administrative Codes
 - 9. ANSI TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - 10. ANSI TIA-526-14-C Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - 11. ANSI TIA-568-C.0 Generic Telecommunications Cabling For Customer Premises
 - 12. ANSI TIA-568-C.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
 - 13. ANSI TIA-568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - 14. ANSI TIA-568-C.3 Optical Fiber Cabling Components Standard
 - 15. ANSI TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
 - 16. ANSI TIA-569-D Telecommunications Pathways and Spaces
 - 17. ANSI TIA-570-C Residential Telecommunications Infrastructure Standard
 - 18. ANSI TIA-598-D Optical Fiber Cable Color Coding
 - 19. ANSI TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure

20. ANSI TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
21. ANSI TIA-758-B Customer-owned Outside Plant Telecommunications Infrastructure Standard
22. National Fire Protection Agency (NFPA - 70), National Electrical Code (NEC)

1.4 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data: provide one submittal containing the following information:
 1. Submittal data for access control cabling and components shall consist of catalog cuts showing technical data necessary to evaluate the materials.
 2. Shop Drawings:
 - a. Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.
 - 1) Detailed wiring diagrams and system description.
 - 2) System device locations on architectural floor plans that include both Div 28 devices and associated Div 8 door hardware.

1.5 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings.
 - b. Include manufacturer's maintenance information.
 - c. Operation and Maintenance Data: Include detailed information on device programming and setup.
 2. Startup and test reports: Submit reports immediately upon completion of tests.
 3. Manufacturer's Warranty: Submit manufacturers standard warranty document.
 4. System training.
 5. As-builts.

1.6 WORK BY OTHERS

- A. Unless noted otherwise, the building's Electrical Contractor will provide field device backboxes as needed, and conduit paths for use by Access Control Contractor. Coordinate backbox and pathway requirements with Electrical Contractor. In general, the following is provided:
 1. Available space on Telecom Room plywood wall to surface mount head end equipment as required with telecommunications room ground bus bar available for grounding.

1.7 FIRESTOPPING

- A. Contractor shall be responsible for firestopping all conduit sleeves and cable tray where required to maintain integrity of fire and/or smoke walls. Contractor shall see architectural drawings for walls that require fire rating.

1.8 ACCEPTABLE ACCESS CONTROL CONTRACTORS

- A. The following contractors are pre-approved to bid this job:
 - 1. Access Control Contractor shall be a manufacturer authorized Dealer, verifiable by the manufacturer's representative. The Access Control Contractor shall also provide as a submittal documentation that they have been and continue to be an established manufacturer authorized dealer in good standing for a minimum of six continuous months before the project bid date. Bidding the project without certifications and attempting to acquire certifications after the bid is not acceptable.
 - 2. Contractor shall be located within 125 miles of the construction site to establish a potential two-hour response time for ongoing customer needs after construction completion.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL CABLING AND COMPONENTS

- A. Acceptable Access Control System Manufacturers:
 - 1. Avigilon
- B. Acceptable Access Control System Components:
 - 1. Card Readers
 - a. HID
 - 2. Access Control Cable
 - a. CSC WESSCO
 - b. Belden
 - 3. Access Control Power Supply and Battery Backup
 - a. Same as Access Control System
 - b. Altronix
 - c. LifeSafety Power
 - 4. Access Control Door Controller
 - a. Same as Access Control System
 - b. Mercury Security
- C. Additional Access Control Requirements:
 - 1. The Access Control Contractor shall install and configure all local access control panels in the identified telecommunication rooms on the construction plans. Unless noted otherwise.

2. The Access Control Contractor shall program all security system databases hardware configurations.
3. The Access Control Contractor shall test and certify all access control communication and operation in accordance with the specifications and manufactures recommendations.
4. The Access Control Contractor shall provide and install all cabling necessary for a complete and operational system taking into account all access control system devices called out on the plans (door contacts of all types, card readers, request to exit devices either internal to door hardware or surface mounted, and electrified door hardware of all types).
 - a. Access control cabling shall be home-run to the main system hardware, no splicing.
5. Any door identified on the plans that has any of the system components {door contacts (sometimes called position switches) of all types, card readers, request to exit devices, electrified door hardware of all types} shall be considered an access control system door.
6. Any door that is considered an access control system door shall have door contacts that can ensure the door is in the closed position and that the door is latched unless specifically noted otherwise. Both sides of a contact shall have a dedicated alarm point in the system.
7. If an electric strike is being provided with a latch bolt monitoring contact internal to the strike, a door slab contact shall still be provided to monitor the position of the slab. It shall be the Access Control Contractors responsibility to:
 - a. Verify that a suitable latch bolt monitoring contact is being specified in the door hardware or point out that what is specified is not compatible with the access control product being provided or the system requirements placed upon the Contractor.
 - b. Provide and install a door slab contact which, when these two are used together, accomplish the requirements of knowing that the door slab is physically closed, and the door hardware is engaged therefore ensuring a secured doorway.
8. The Access Control Contractor shall provide door controllers for all access control doors on the project that require a controller.
9. The Access Control Contractor shall provide and install all devices not specifically identified on the plans which are required for a complete and operational system for all access control system doors.
10. The Access Control Contractor shall provide and install one client software package on an Owner provided computer.
11. The Access Control Contractor shall provide training to all client operators and or managers identified by the client.
12. The Access Control Contractor shall furnish 200 proximity cards.
13. ADA door operation: Doors that are part of the access control system and have ADA electric openers shall be subject to the following hardware/software requirements.
 - a. The Access Control Contractor shall provide and install the necessary physical equipment and/or programming or other soft services necessary to meet these requirements.

- b. The card reader shall be located in close proximity to the ADA button (whether on the building wall or on a bollard or equivalent).
 - c. During times when the system is scheduled to have the door of interest unlocked, pressing the ADA button (no card presentation required) shall physically open the door (and retract the latch as necessary). The access control system shall only unlock door trims during the unlocked door schedule (the latch shall remain engaged so the door cannot be opened by the wind or by people without using the door hardware). The Access Control Contractor shall coordinate with door hardware provided.
 - d. During times when the system is scheduled to have the door of interest locked, pressing the ADA button without a valid card presentation shall not activate any electric door hardware or electric opening devices.
 - e. During times when the system is scheduled to have the door of interest locked, pressing the ADA button after a valid card presentation shall activate any electric door hardware necessary to unlatch the door and activate the electric opening device(s).
 - 1) The valid card presentation shall only allow activation of these electrical systems for a limited amount of time after the card presentation.
 - 2) At no time shall a valid card presentation automatically activate the electric door opening device.
 - 3) Pressing the ADA button to have the door electrically open shall always be required, subject to the requirements listed above.
14. The Access Control head end (all cabinets if multiple) shall be furnished and installed with a minimum 7ah of battery backup serving no more than 8 doors each (i.e. if one panel serves 16 doors, then two 7ah batteries are required minimum). A battery backed power supply of the same manufacturer as the access control system shall be used if available, otherwise see this spec. 2.01 B.8 for an acceptable manufacturer to use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install systems cables and auxiliary materials as indicated in accordance with access control manufacturer's written instructions, and recognized industry practices.
 - 1. Contractor shall use hook and loop type fasteners on all security cable. Tie wraps shall not be used.
- B. Identify all cables as to field location.
 - 1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic coated type or write-on type with clear plastic self-adhesive cover flap; numbered to show cable identification. Install within 6" of cable end.

- C. After completion, all cables shall be thoroughly tested.
 - 1. Contractor shall provide all instruments for testing the cables.
 - 2. Contractor shall demonstrate in the presence of Owner's representative that the access control is complete and operational.
 - 3. Contractor shall complete and submit the Certificate of System Demonstration.
- D. After completion, comprehensive As-Builts will be created and provided to Owner within 14 days.
 - 1. Two hard copies shall be provided to Owner detailing the entire access control after installation. Each field position shall be labeled and cross referenced to the appropriate head end position for ease of troubleshooting.

3.2 COMMISSIONING

- A. The Contractor shall coordinate a date/time with the Engineer after the system is fully operational, but before final payment, for the Contractor to provide a full system demonstration. This shall include all aspects of system operation that the user might encounter.

3.3 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration. Training date shall be coordinated with the facility owner.

END OF SECTION 285000

SECTION 286000 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Division 00 – Procurement, Contracting and Warranty Requirements, Division 01 - General Requirements and Section 280010 – Electronic Safety and Security General Provisions are applicable to work required of this section.

1.2 DESCRIPTION OF WORK

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this surveillance system in compliance with the specifications and drawings. Contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

1.3 SUBMITTALS

- A. Refer to Division 01 Submittal requirements.
- B. Product data: provide one submittal containing the following information:
 - 1. Submittals for all Manufacturer and Contractor certifications (noted below) shall be submitted first.
 - 2. Manufacturer's catalog cuts showing technical data necessary to evaluate the materials for surveillance cabling and components.
- C. Shop Drawings:
 - a. Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.
 - 1) Detailed wiring diagrams and system description.
 - 2) System device locations on architectural floor plans.

1.4 CLOSEOUT DOCUMENTS

- A. Refer to Division 01 Closeout requirements.
- B. Provide closeout items containing the following:
 - 1. Operation and Maintenance Manual:
 - a. Include approved Product Data and Shop Drawings.
 - b. Include manufacturer's maintenance information.
 - c. Operation and Maintenance Data: Include detailed information on device programming and setup.

2. Startup and test reports: Submit reports immediately upon completion of tests.
3. Manufacturer's Warranty: Submit manufacturers standard warranty document.
4. System training.
5. As-builts.

1.5 WORK BY OTHERS

- A. Unless noted otherwise, the building's Electrical Contractor will provide field device backboxes as needed, and conduit paths for use by surveillance Video Surveillance Contractor. In general, the following is provided:
1. Grounded 19" data rack in Telecom Room by Telecom Contractor to mount head end equipment to.
 2. Available space on Telecom Room wall for power supply.

1.6 FIRESTOPPING

- A. Contractor shall be responsible for firestopping all conduit sleeves and cable tray where required to maintain integrity of fire and/or smoke walls. Contractor shall see architectural drawings for walls that require fire rating.

1.7 ACCEPTABLE VIDEO SURVEILLANCE CONTRACTORS

- A. The following contractors are pre-approved to bid this job:
1. Video Surveillance Contractor shall be a certified dealer of the Acceptable Manufacturer in this spec, section 2.01, A. Shall be in good standing for a minimum of six continuous months before the project bid date. This shall include factory trained and certified technicians in house for the installation of this project (six months experience applies here also). The dated dealer certification document and the dated technician training certificate are each required submittal items.
 2. Video Surveillance Contractor shall be a certified camera dealer of the Acceptable Manufacturer in this spec, section 2.01, C. Shall be in good standing for a minimum of six continuous months before the project bid date. This shall include factory trained and certified technicians in house for the installation of this project (six months experience applies here also). The dated dealer document and the dated technician training certificate are each required submittal items.
 3. The four or more submittal items (if multiple technicians) noted above are all criteria which determine if the Contractor is authorized to enter the project and begin work. No project work shall be authorized until these submittals are reviewed with a favorable response. Product data submittals are a separate submittal package and shall only be reviewed after the above items are resolved.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE CABLING AND COMPONENTS

A. Acceptable Video Management System Manufacturers:

1. Avigilon Premium Series

B. Acceptable Video Management Storage Servers:

1. Avigilon Premium Series with 2x10 GbE SFP+ ports

C. Acceptable Video Surveillance Camera Manufacturers:

1. Avigilon

D. Additional Video Surveillance Requirements:

1. All power and video cables shall be homerun, no splicing.
2. The Contractor shall provide new Local video storage server for this project.
3. Total required video storage is calculated on:
 - a. Minimum video compression: H.264
 - b. Maximum resolution for selected cameras
 - c. Minimum Frames Per Second: 10 FPS
 - d. Percentage of motion: 70%
 - e. Hours of active video: 24 hours
 - f. Duration of video storage: 30 days
 - g. Required storage space for future growth: 20%
4. The Contractor shall furnish and install the required amount of video storage based off the criteria for calculations stated in the spec, section 2.01. D.
5. Contractor shall coordinate with the Owner regarding setting up access to the system for individuals.
6. The Contractor shall furnish camera licenses for all cameras provided on the project, and program all the associated DLK's (device license key) into the software to make the cameras operational.
7. 5 year Avigilon software upgrade program shall be provided with each camera in the project.
8. The field of views indicated on the construction plans are for general aiming direction only. The Contractor shall aim all cameras per Owner's direction with the understanding that multiple trips to the camera for aiming will be required.
9. The Contractor shall program all camera names into the system per Owner direction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install surveillance systems cables and auxiliary materials as indicated in accordance with manufacturer's written instructions, and recognized industry practices.
 - 1. Contractor shall use hook and loop type fasteners on all security cable. Tie wraps shall not be used.
- B. Identify all cables as to field location.
 - 1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic-coated type or write-on type with clear plastic self-adhesive cover flap; numbered to show cable identification. Install within 6" of cable end.
- C. The field of views indicated on the construction plans are for general aiming direction only. The Contractor shall aim all cameras per Owner's direction with the understanding that multiple trips to the camera for aiming will be required.
- D. The Contractor shall program all camera names into the system per Owner direction.

3.2 COMMISSIONING

- A. The Contractor shall coordinate a date/time with the Engineer after the system is fully operational, but before final payment, for the Contractor to provide a full system demonstration. This shall include all aspects of system operation that the user might encounter.

3.3 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration. Training date shall be coordinated with the facility owner.

END OF SECTION 286000